

PTO/SB/21 (03-03)

TRANSMITTAL FORM <small>(to be used for all correspondence after initial filing)</small>	Application Number	09/378,586
	Filing Date	August 20, 1999
	First Named Inventor	Moore, Morris Anthony et al.
	Group Art Unit	2635
	Examiner Name	Brown, Vernal U.
Total Number of Pages in this Submission	Attorney Docket Number	PF01800NA

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ENCLOSURES			(check all that apply)
<input checked="" type="checkbox"/> Fee Transmittal Form <input type="checkbox"/> Fee Attached <input type="checkbox"/> Amendment/Reply <input type="checkbox"/> After Final <input type="checkbox"/> Affidavits/Declaration(s) <input type="checkbox"/> Extension of Time Request <input type="checkbox"/> Express Abandonment Request <input type="checkbox"/> Information Disclosure Statement <input type="checkbox"/> Certified Copy of Priority Documents <input type="checkbox"/> Response to Missing Parts/ Incomplete Application <input type="checkbox"/> Response to Missing Parts Under 37 CFR 1.52 or 1.53	<input type="checkbox"/> Drawing(s) <input type="checkbox"/> Licensing-Related papers <input type="checkbox"/> Petition <input type="checkbox"/> Petition to Convert to a Provisional Application <input type="checkbox"/> Power of Attorney, Revocation, Change of Correspondence Address <input type="checkbox"/> Terminal Disclaimer <input type="checkbox"/> Request for Refund <input type="checkbox"/> CD, Number of CDs	<input type="checkbox"/> After Allowance Communication to a Technology Center (TC) <input type="checkbox"/> Appeal Communication to Board of Appeals and Interferences <input checked="" type="checkbox"/> Appeal Communication to TC (Appeal Notice, Brief, Reply Brief) <input type="checkbox"/> Proprietary Information <input type="checkbox"/> Status Letter with appropriate copies <input type="checkbox"/> Other Enclosure(s) (please identify below)	
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Signature	<i>Hisashi W. Watanabe</i>		
Date	8/19/03		

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FEE TRANSMITTAL

Patent fees are subject to annual revision

☐ Applicant claims small entity status. See 37 CFR 1.27

Complete if Known

Application Number 09/378,586
Filing Date August 20, 1999
First Named Inventor Moore, Morris Anthony et al.
Examiner Name Brown, Vernal U.
Group Art Unit 2635
Attorney Docket No. PF01800NA

TOTAL AMOUNT OF PAYMENT (\$ 320.00)

METHOD OF PAYMENT (check all that apply)

☐ Check ☐ Credit card ☐ Money Order ☐ Other ☐ None

☒ Deposit Account:

Deposit Account Number 502117

Deposit Account Name Motorola, Inc.

The Director is authorized to: (check all that apply)

☒ Charge fee(s) indicated below ☒ Credit any overpayments

☐ Charge any additional fee(s) during the pendency of this application

☐ Charge fees(s) indicated below, except for the filing fee to the above-identified deposit account.

FEE CALCULATION

1. BASIC FILING FEE

Large Fee Code	Entity Fee (\$)	Small Fee Code	Entity Fee (\$)	Fee Paid
1001	750	2001	375	Utility filing fee
1002	330	2002	165	Design filing fee
1003	520	2003	260	Plant filing fee
1004	750	2004	375	Reissue filing fee
1005	160	2005	80	Provisional filing fee

SUBTOTAL (1) (\$)

2. EXTRA CLAIM FEES

Total Claims	Previously Paid**	Extra Claims	Fee from below	Fee Paid
Independent Claims	20	X	18	
	3	X	84	

Multiple Dependent

280 =

Large Fee Code	Entity Fee (\$)	Small Fee Code	Entity Fee (\$)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	84	2201	42	Independent claims in excess of 3
1203	280	2203	140	Multiple dependent claim, if not paid
1204	84	2204	42	* Reissue independent claims over original patent
1205	18	2205	9	* Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) (\$)

**OR NUMBER PREVIOUSLY PAID, IF GREATER THAN STANDARD ALLOWANCE.

*For Reissues, see above

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Date

8/19/03

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee (\$)	Small Entity Fee Code	Small Entity Fee (\$)	Fee Description
1051	130	2051	65	Surcharge - late filing fee or oath
1052	50	2052	25	Surcharge - late Provisional filing
1053	130	1053	130	Non-English specification
1812	2520	1812	2520	For filing a request for ex parte Reexamination
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action
1805	1840*	1805	1840*	Requesting publication of SIR after Examiner action
1251	110	2251	55	Extension for reply within first month
1252	410	2252	205	Extension for reply within second month
1253	930	2253	465	Extension for reply within third month
1254	1450	2254	725	Extension for reply within fourth month
1255	1970	2255	985	Extension for reply within fifth month
1401	320	2401	160	Notice of Appeal
1402	320	2402	160	Filing a brief in support of an appeal
1403	280	2403	140	Request for oral hearing
1451	1510	1451	1510	Petition to institute a public use proceeding
1452	110	2452	55	Petition to revive - unavoidable
1453	1300	2453	650	Petition to revive - unintentional
1501	1300	2501	650	Utility issue fee (or reissue)
1502	470	2502	235	Design issue fee
1503	630	2503	315	Plant issue fee
1460	130	1460	130	Petitions to the Commissioner
1807	50	1807	50	Processing fee under 37 CFR 1.17(q)
1806	180	1806	180	Submission of IDS
8021	40	8021	40	Recording each patent assignment per property (times number of properties)
1809	750	2809	375	Filing a submission after final rejection (37 CFR § 1.129(a))
1810	750	2810	375	For each additional invention to be examined (37 CFR § 1.129(b))
1801	750	2801	375	Request for Continued Examination (RCE)
1802	900	1802	900	Request for expedited examination of a design application

Other fee (specify)

* Reduced by Basic Filing Fee paid

SUBTOTAL (3) (\$ 320.00)

Complete (if applicable)

#12
MDJ
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

APPLICANT: Moore, Morris Anthony, et al.)
SERIAL NO.: 09/378,586)
FILED: August 20, 1999)
TITLED: Method and Apparatus For Locating a)
Nearby Alternative Vending Machine)
For a Desired Product)
EXAMINER: Brown, Vernal U.)
GROUP: 2635)
FILE NO.: PF01800NA)

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APPELLANTS' BRIEF UNDER 37 CFR 1.192

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August 19, 2003

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EXHIBITS

Exhibit A - Claims As Pending

Exhibit B - U.S. Patent No. 5,091,713 to Horne, et al.

Exhibit C - U.S. Patent No. 6,418,416 to Rosenberg, et al.

Exhibit D - U.S. Patent No. 5,525,967 to Azizi, et al.

I. Real Party in Interest

The party named in the caption of this brief is the real party in interest.

II. Related Appeals and Interferences

There are no other appeals of interferences known to the Applicant, the Applicant's legal representative, or assignee which would directly affect or be directly affected by or having a bearing on the Board's decision in this pending appeal.

III. Status of the Claims

Claims 19 through 21 are allowed.

Claims 1, 3, 4, 6 through 8, 10, 11, 13, 14, 16 and 17 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,091,713 to Horne, et al. ("Horne, et al. patent") in view of U.S. Patent No. 6,418,416 to Rosenberg, et al. ("Rosenberg, et al. patent").

Claims 5, 9 and 15 are rejected under 35 U.S.C. §103(a) as being unpatentable over the Horne, et al. patent in view of the Rosenberg, et al. patent and U.S. Patent No. 5,525,967 to Azizi, et al. ("Azizi, et al. patent").

IV. Status of the Amendments

Although a response was filed on May 21, 2003, i.e., subsequent to the final rejection, no response making amendments to the claims was filed subsequent to the final rejection.

V. Summary of the Invention

The present invention relates to a method, apparatus and server for locating a nearby alternate vending machine having a desired product.

For the method, information from nearby vending machines for coordinating product availability and vending machine location is made available to a particular vending machine. If the particular vending machine determines that a desired product is no longer available from itself, the particular vending machine obtains the information comprising a location of each nearby alternate vending machine for the desired product. The particular vending machine then conveys the location or locations to a customer in response to a selection of the desired product by the customer.

The apparatus is used for a particular vending machine having an inventory sensor and a customer interface, and for locating a nearby alternate vending machine having a desired product. The apparatus comprises a transceiver and a processing system coupled to the transceiver, the inventory sensor and the customer interface. The transceiver provides communications, and the processing system controls the transceiver. The processing system is programmed to cooperate with the inventory sensor to determine that the desired product is no longer available at the particular vending machine, cooperate with the transceiver to obtain information made available to the particular vending machine from vending machines for coordinating product availability and vending machine location, and cooperate with the customer interface to convey the location to a customer in response to a selection of the desired product by the customer through the customer interface. The information made available comprises a location of one or more nearby alternate vending machines for the desired product.

The server determines a location of an alternate vending machine near a particular vending machine, in which the alternate vending machine has a desired product that is unavailable at the particular vending machine. The server comprises a processing system and a transceiver coupled to the processing system for communicating with the vending machines. The processing system is programmed to cooperate with the transceiver to receive from the particular vending machine a particular query regarding the desired product, determine a candidate alternate vending machine near the particular vending machine, transmit a second query regarding the desired product to the candidate alternate vending machine, receive a response from the candidate alternate vending machine indicating that the desired product is available, thereby defining the candidate alternate vending machine as the alternate vending machine for the desired product, and return to the particular vending machine said location of the alternate vending machine.

VI. Issues

Whether claims 1, 3, 4, 6 through 8, 10, 11, 13, 14, 16, and 17 are unpatentable under 35 U.S.C. §103(a) as being obvious in view of the Horne, et al. patent and the Rosenberg, et al. patent.

Whether claims 5, 9 and 15 are unpatentable under 35 U.S.C. §103(a) as being obvious in view of the Horne, et al. patent, the Rosenberg, et al. patent and the Azizi, et al. patent.

VII. Grouping of the Claims

Claims 1, 3 through 11 and 13 through 17 stand or fall together.

VIII. Argument: Claims 1, 3 through 11, and 13 through 17 Are Not Obvious In View Of the Horne, et al. Patent and the Rosenberg, et al. Patent

A. Claims 1, 3, 4, 6 through 8, 10, 11, 13, 14, 16, and 17 Are Not Obvious In View Of the Horne, et al. Patent and the Rosenberg, et al. Patent

Claim 1 provides "conveying by the first vending machine said location to a customer in response to a selection of the desired product by the customer" and, similarly, claim 11 provides a processing system that is programmed to "cooperate with the customer interface to convey said location to a customer in response to a selection of the desired product by the customer through the customer interface".

In contrast, the Horne, et al. patent, the Rosenberg, et al. patent, and the Azizi, et al. patent do not describe or suggest conveying a location of a nearby alternate vending machine for a desired product to a customer in response to a selection of the desired product by the customer, as required by claims 1 and 11. The Horne, et al. patent describes a vending machine that dispenses a product in response to a product selection by a customer, but the vending machine does not convey location information in response to a product selection by a customer. Similarly, the Rosenberg, et al. patent describes cabinets that dispense products in response to product selections by customers, but the cabinets do not convey location information *in response to product selections by customers* (see below). Likewise, the Azizi, et al. patent does not describe or suggest any type of action in response to a product selection by a customer.

The above Office Action states that the Rosenberg, et al. patent teaches that queries are made based on a product selected (col. 6, line 47) and, therefore, the information is conveyed in response to an item selection. However, the Examiner's interpretation of the Rosenberg, et al.

patent is not entirely correct. As shown in FIG. 6 and described at col. 6, lines 45 through 51 of the Rosenberg, et al. patent, this patent describes a system and method in which a user may enter a query based on partial item names or descriptions and the user may view items that match the query. The viewed items include current cabinet location and inventory. Thereafter, the user may view detailed item descriptions of items in the cabinet or view cabinet inventory. It is important to note that, at the point when items and descriptions are viewed, the user has thus far only provided partial item names or descriptions and a product has not yet been selected. In fact, the items and their corresponding descriptions are provided to the user to assist him or her in selecting one or more of the items. Accordingly, the Rosenberg, et al. patent does not describe or suggest conveying a location of a nearby alternate vending machine for a desired product to a customer *in response to a selection of the desired product by the customer*, as required by claims 1 and 11

Claims 1 and 11 distinguish from the Rosenberg, et al. patent for several other reasons. The Rosenberg, et al. patent, at col. 5, line 40, through col. 6, line 2, describes a system and method in which access to relevant information is restricted to authorized users. The authorized users of the Rosenberg, et al. patent are quite different from the customers of claims 1 and 11. Also, the system and method of the Rosenberg, et al. patent allows users to be added using a special procedure where users must first log in (col. 6, line 36; col. 6, line 57; and FIG. 7). Accordingly, information is not conveyed in response to a product selection, as required by claims 1 and 11.) Further, the system and method of the Rosenberg, et al. patent requires a user to specify a partial name or description (col. 6, line 47) to a browser in order to search for articles. Again, information is not conveyed in response to a product selection, as required by claims 1 and 11. Still further, the system and method of the Rosenberg, et al. patent, in response to an inquiry, returns a list of cabinets that contain the article, so the user is required to manually

investigate the list to identify and locate a nearby cabinet having the desired product. Thus, the system and method of the Rosenberg, et al. patent does not identify the nearby alternate vending machine for the desired product, as required by claims 1 and 11.

Therefore, claims 1 and 11 distinguish patentably from the Horne, et al. patent, the Rosenberg, et al. patent, the Azizi, et al. patent, and any combination of these patents.

Claims 3, 4, 6 through 8, 10, 13, 14, 16 and 17 depend from and include all of the limitations of independent claims 1 and 11. Therefore, claims 3, 4, 6 through 8, 10, 13, 14, 16 and 17 distinguish patentably from the Horne, et al. patent, the Rosenberg, et al. patent, the Azizi, et al. patent, and any combination of these patents for the reasons stated above for claims 1 and 11.

In view of the above, reconsideration and withdrawal of the rejections of claims 1, 3, 4, 6 through 8, 10, 11, 13, 14, 16 and 17 are respectfully requested.

B. Claims 5, 9 and 15 Are Not Obvious In View Of the Horne, et al. Patent, the Rosenberg, et al. Patent and the Azizi, et al. Patent

Claims 5, 9, and 15 are rejected under 35 U.S.C. §103(a) as being unpatentable over the Horne, et al. patent in view of the Rosenberg, et al. patent and the Azizi, et al. patent.

Claims 5, 9 and 15 depend from and include all of the limitations of independent claims 1 and 11. Therefore, claims 5, 9 and 15 distinguish patentably from the Horne, et al. patent, the Rosenberg, et al. patent, the Azizi, et al. patent, and any combination of these patents for the reasons stated above for claims 1 and 11.

In view of the above, reconsideration and withdrawal of the rejections of claims 5, 9 and 15 are respectfully requested.

X. Conclusion

For the reason set forth above, Applicant respectfully requests reconsideration of the claims as pending in view of the above remarks.

Respectfully submitted,

Moore, Morris Anthony, et al.

by: Hisashi D. Watanabe

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EXHIBIT A - CLAIMS AS PENDING

1. A method in a first vending machine of a plurality of vending machines for locating a nearby alternate vending machine having a desired product, the method comprising the steps of:

making available to the first vending machine information from nearby ones of the plurality of vending machines for coordinating product availability and vending machine location;

determining, by the first vending machine, that the desired product is no longer available at the first vending machine;

obtaining thereafter, by the first vending machine, the information comprising a location of the nearby alternate vending machine for the desired product; and

conveying by the first vending machine said location to a customer in response to a selection of the desired product by the customer.

2. (Canceled)

3. The method of claim 1, wherein the obtaining step comprises the steps of:
maintaining in the first vending machine a list of candidate alternate vending machines located near the first vending machine; and
communicating with at least one of the candidate alternate vending machines to locate the desired product, when the first vending machine has no availability of the desired product.
4. The method of claim 1, wherein the obtaining step comprises the steps of:
communicating, by a transceiver having a limited range, with at least one candidate alternate vending machine within range of the transceiver, when the first vending machine has no availability of the desired product.
5. The method of claim 4, wherein the obtaining step further comprises the steps of:
querying the at least one candidate alternate vending machine for its location;
calculating a distance from the first vending machine to the at least one candidate alternate vending machine; and
defining the at least one candidate alternate vending machine to be the nearby alternate vending machine for the desired product, only when the distance is less than a predetermined distance.

6. The method of claim 1, wherein the plurality of vending machines also communicate with a server, and wherein the obtaining step comprises the steps of:

sending by the first vending machine a first query to the server regarding the desired product, in response to the first vending machine exhausting all stock of the desired product;

determining by the server a candidate alternate vending machine near the first vending machine;

transmitting by the server a second query regarding the desired product to the candidate alternate vending machine;

receiving, by the server, a response from the candidate alternate vending machine indicating that the desired product is available, thereby defining the candidate alternate vending machine as the nearby alternate vending machine for the desired product; and

returning by the server to the first vending machine said location of the nearby alternate vending machine.

7. The method of claim 6, further comprising in the server the steps of:

recording, in a transactions list, an entry comprising identifiers of the first vending machine, the nearby alternate vending machine, and the desired product;

receiving a report from one of the plurality of vending machines indicating that a product is no longer available;

comparing an identifier of the one of the plurality of vending machines and the product with the transactions list to determine whether the one of the plurality of vending machines is serving as the nearby alternate vending machine for the product; and

finding for the first vending machine another alternate vending machine for the product, when the one of the plurality of vending machines is serving as the nearby alternate vending machine for the product.

8. The method of claim 6, further comprising in the server the steps of:

recording, in a transactions list, an entry comprising identifiers of the first vending machine and the nearby alternate vending machine, and the desired product;

receiving a report from one of the plurality of vending machines indicating that a product has become available;

comparing an identifier of the one of the plurality of vending machines and the product with the transactions list to determine whether the one of the plurality of vending machines is the first vending machine and the product is the desired product; and

clearing the entry in the transactions list, when the one of the plurality of vending machines is the first vending machine and the product is the desired product.

9. The method of claim 8, further comprising in the server the steps of:

determining whether the one of the plurality of vending machines is nearer than the nearby alternate vending machine is to the first vending machine, when the one of the plurality of vending machines is not the first vending machine and the product is the desired product; and

redefining, for the first vending machine, the one of the plurality of vending machines as the nearby alternate vending machine for the desired product, when the server has determined the one of the plurality of vending machines is nearer to the first vending machine.

10. The method of claim 1, wherein the plurality of vending machines also communicate with a server, and wherein the method further comprises the steps of:

communicating to the server by ones of the plurality of vending machines a product availability indicator whenever a product availability changes; and

maintaining in the server a database of current product availability indicators and corresponding vending machine locations, and

wherein the obtaining step comprises the steps of:

requesting from the server by the first vending machine said location of the nearby alternate vending machine for the desired product, when the customer selects the desired product at the first vending machine; and

sending, thereafter by the server, said location to the first vending machine.

11. An apparatus in a first vending machine having an inventory sensor and a customer interface, the apparatus for locating a nearby alternate vending machine having a desired product, the apparatus comprising:

a transceiver for providing communications; and
a processing system coupled to the transceiver for controlling the transceiver and processing the communications, the processing system further coupled to the inventory sensor and the customer interface,

wherein the processing system is programmed to:

cooperate with the inventory sensor to determine that the desired product is no longer available at the first vending machine;

cooperate with the transceiver to obtain information made available to the first vending machine from a plurality of vending machines for coordinating product availability and vending machine location, the information comprising a location of the nearby alternate vending machine for the desired product; and

cooperate with the customer interface to convey said location to a customer in response to a selection of the desired product by the customer through the customer interface.

12. (Canceled)

13. The apparatus of claim 11, wherein the processing system is programmed to:
maintain a list of candidate alternate vending machines located near the first vending machine; and
control the transceiver to communicate with at least one of the candidate alternate vending machines to locate the desired product, when the first vending machine has no availability of the desired product.
14. The apparatus of claim 11,
wherein the transceiver has a limited range, and
wherein the processing system is programmed to communicate with at least one candidate alternate vending machine within range of the transceiver, when the first vending machine has no availability of the desired product.
15. The apparatus of claim 14, wherein the processing system is programmed to:
query the at least one candidate alternate vending machine for its location;
calculate a distance from the first vending machine to the at least one candidate alternate vending machine; and
define the at least one candidate alternate vending machine to be the nearby alternate vending machine for the desired product, only when the distance is less than a predetermined distance.

16. The apparatus of claim 11, wherein the plurality of vending machines communicate with a server, and wherein the processing system is further programmed to:

send a first query to the server regarding the desired product, in response to the first vending machine exhausting all stock of the desired product; and

receive from the server said location of the nearby alternate vending machine.

17. The apparatus of claim 16, wherein the processing system is further programmed to:

send a report to the server indicating that a product has become available, in response to the product being restocked after having been unavailable.

18. (Canceled)

19. A server for determining a location of an alternate vending machine near a first vending machine, the alternate vending machine having a desired product that is unavailable at the first vending machine, the server comprising:

a processing system; and

a transceiver coupled to the processing system for communicating with a plurality of vending machines,

wherein the processing system is programmed to:

cooperate with the transceiver to receive from the first vending machine a first query regarding the desired product;

determine a candidate alternate vending machine near the first vending machine;

transmit a second query regarding the desired product to the candidate alternate vending machine;

receive a response from the candidate alternate vending machine indicating that the desired product is available, thereby defining the candidate alternate vending machine as the alternate vending machine for the desired product;

return to the first vending machine said location of the alternate vending machine;

record, in a transactions list, an entry comprising identifiers of the first vending machine, the alternate vending machine, and the desired product;

receive a report from one of the plurality of vending machines indicating that a product is no longer available;

compare an identifier of the one of the plurality of vending machines and the product with the transactions list to determine whether the one of the plurality of vending machines is serving as the alternate vending machine for the product; and

find for the first vending machine another alternate vending machine for the

product, when the one of the plurality of vending machines is serving as the alternate vending machine for the product.

20. A server for determining a location of an alternate vending machine near a first vending machine, the alternate vending machine having a desired product that is unavailable at the first vending machine, the server comprising:

- a processing system; and

- a transceiver coupled to the processing system for communicating with a plurality of vending machines,

- wherein the processing system is programmed to:

- cooperate with the transceiver to receive from the first vending machine a first query regarding the desired product;

- determine a candidate alternate vending machine near the first vending machine;

- transmit a second query regarding the desired product to the candidate alternate vending machine;

- receive a response from the candidate alternate vending machine indicating that the desired product is available, thereby defining the candidate alternate vending machine as the alternate vending machine for the desired product;

- return to the first vending machine said location of the alternate vending machine;

- record, in a transactions list, an entry comprising identifiers of the first vending machine, the alternate vending machine, and the desired product;

- receive a report from one of the plurality of vending machines indicating that a product has become available;

- compare an identifier of the one of the plurality of vending machines and the product with the transactions list to determine whether the one of the plurality of vending

machines is the first vending machine and the product is the desired product; and

clear the entry in the transactions list, when the one of the plurality of vending machines is the first vending machine and the product is the desired product.

21. The server of claim 20, wherein the processing system is further programmed to:

determine whether the one of the plurality of vending machines is nearer than the alternate vending machine is to the first vending machine, when the one of the plurality of vending machines is not the first vending machine and the product is the desired product; and

redefine, for the first vending machine, the one of the plurality of vending machines as the alternate vending machine for the desired product, when the server has determined the one of the plurality of vending machines is nearer to the first vending machine.

22. (Canceled)

EXHIBIT B

U.S. PATENT NO. 5,091,713 TO HORNE, ET AL.



US005091713A

United States Patent [19]

Horne et al.

[11] **Patent Number:** 5,091,713[45] **Date of Patent:** Feb. 25, 1992

[54] **INVENTORY, CASH, SECURITY, AND MAINTENANCE CONTROL APPARATUS AND METHOD FOR A PLURALITY OF REMOTE VENDING MACHINES**

[75] **Inventors:** Arthur H. Horne; Ralph J. Henderson, both of Salt Lake City; David C. Anderson, Deer Valley, all of Utah

[73] **Assignee:** Universal Automated Systems, Inc., Salt Lake City, Utah

[21] **Appl. No.:** 521,605

[22] **Filed:** May 10, 1990

[51] **Int. Cl.⁵** G08B 13/00; G06F 7/08

[52] **U.S. Cl.** 340/541; 340/568; 340/665; 340/825.33; 340/825.35; 364/479; 235/381

[58] **Field of Search** 340/665-666, 340/541, 568, 538-539, 679, 683, 521, 825.33-825.35; 364/479, 568; 379/91; 177/45, 25.12; 221/2, 6; 194/216-217; 453/17, 58; 235/381

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Primary Examiner—Jin E. Ng

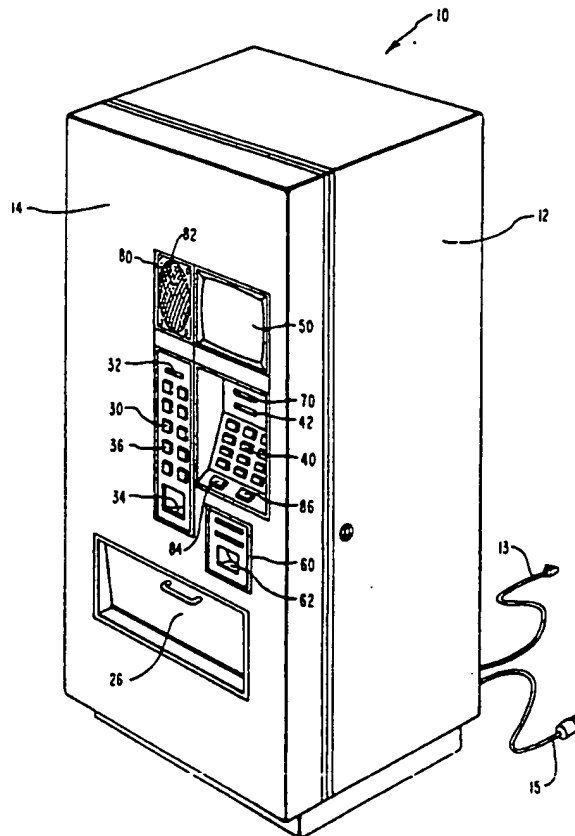
Assistant Examiner—Thomas J. Mullen, Jr.

Attorney, Agent, or Firm—J. Winslow Young

[57]

ABSTRACT

A monitoring system for monitoring a vending machine at a remote location, the monitoring system including an inventory sensing system for providing a continuous update of the inventory in the vending machine, an alarm system to signal when the vending machine is being damaged or the systems in the vending machine are in need of attention, a communication system, and a credit card verification system. The vending machine is coupled to a central computer system which monitors all the systems in the vending machine. The communication system includes a credit card verification system, a two-way communication capability, a display screen, and a printer.

15 Claims, 3 Drawing Sheets

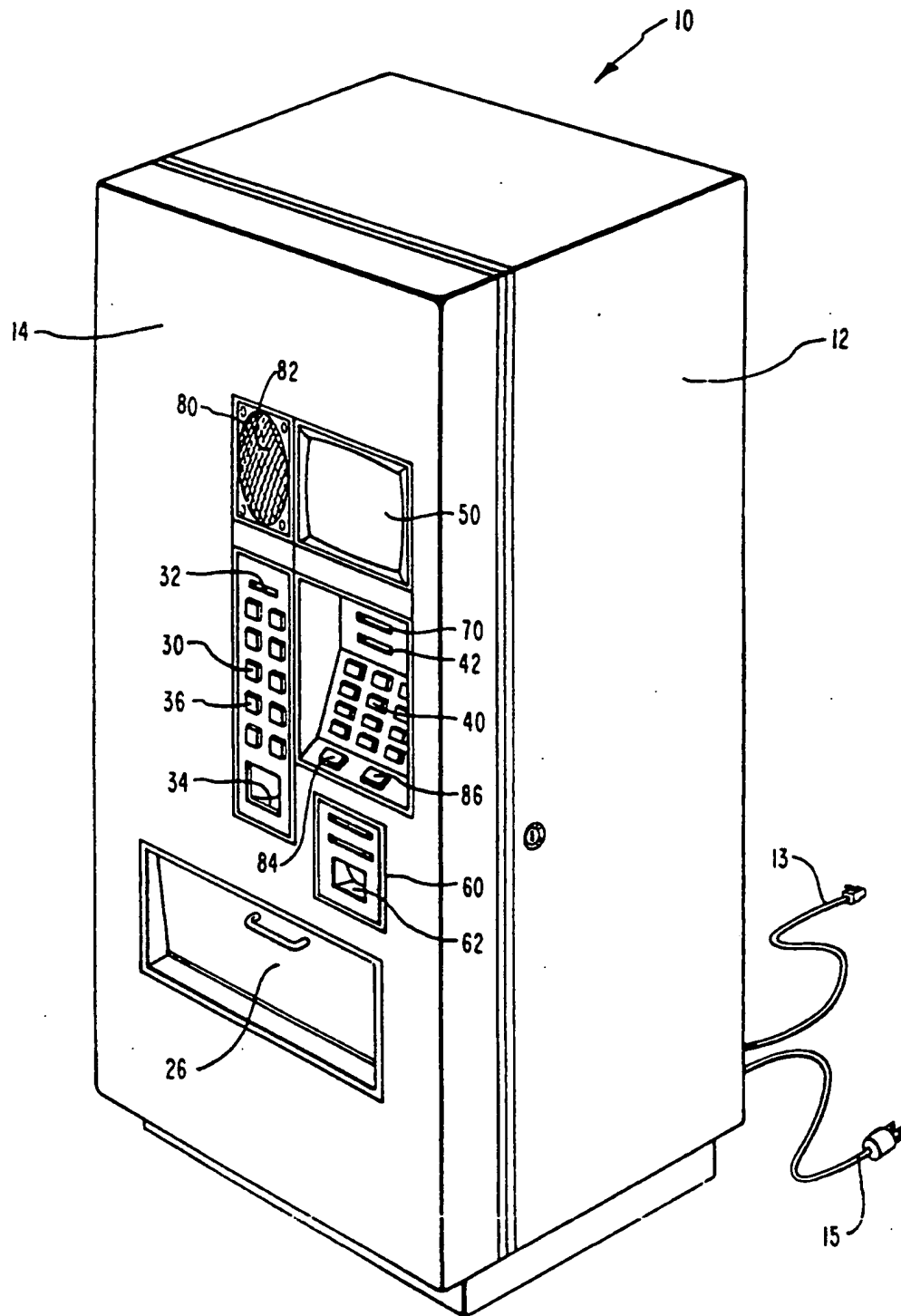


FIG. 1

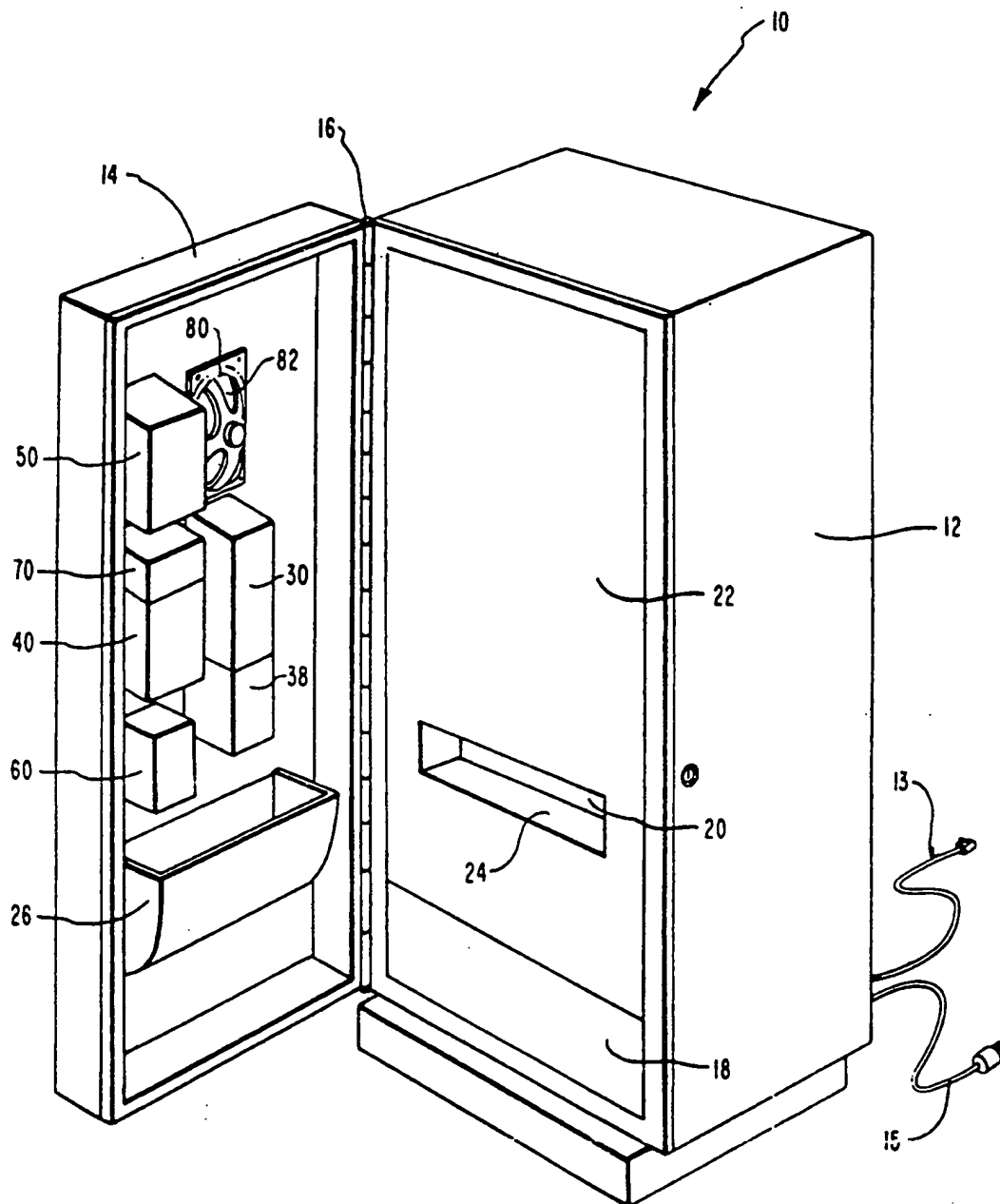


FIG. 2

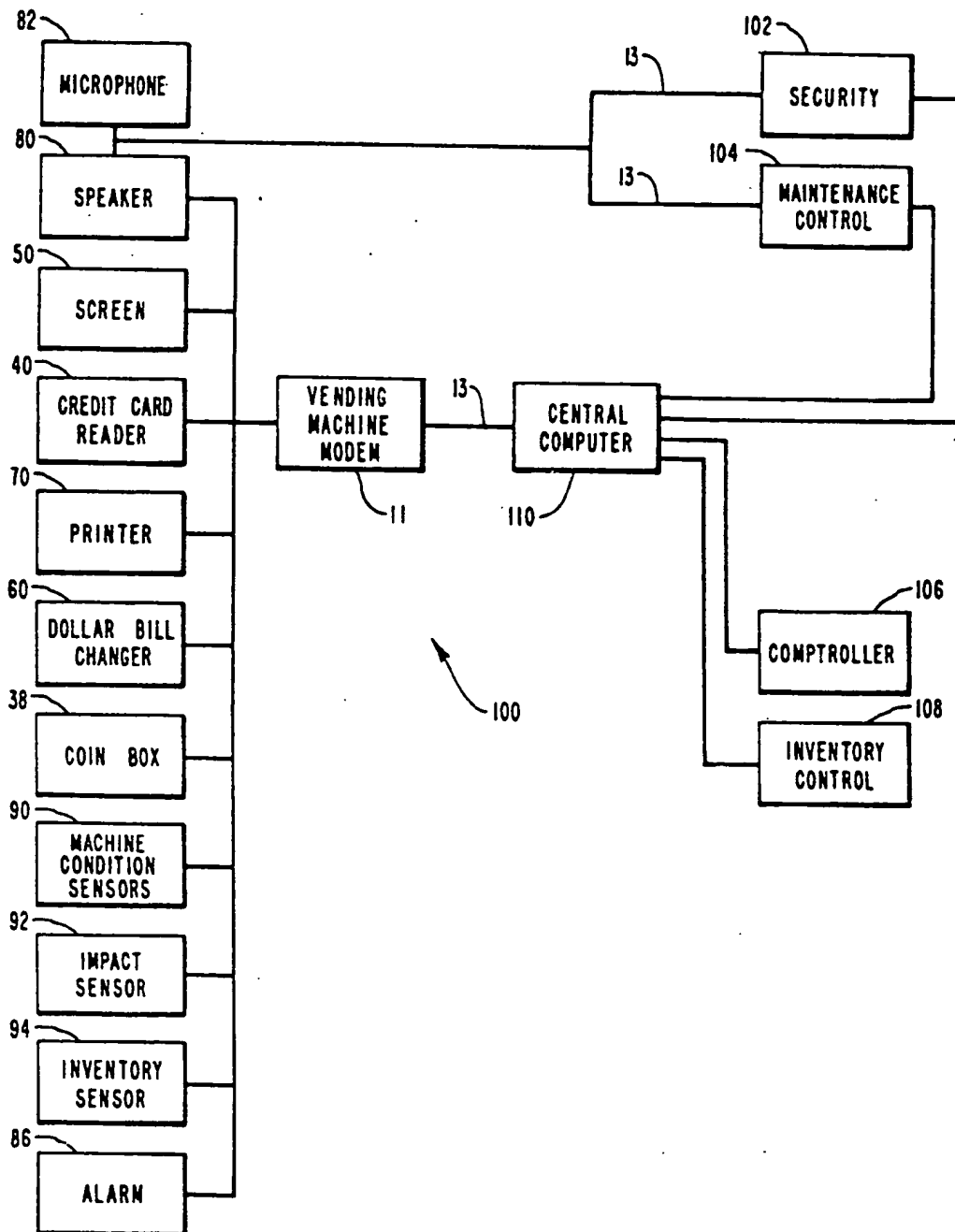


FIG. 3

INVENTORY, CASH, SECURITY, AND MAINTENANCE CONTROL APPARATUS AND METHOD FOR A PLURALITY OF REMOTE VENDING MACHINES

BACKGROUND

1. Field of the Invention

This invention relates to vending machines and, more particularly, to an inventory and security apparatus and method for a plurality of remotely located vending machines.

2. The Prior Art

The term "vending machine" was first used in about 1909 to define a coin-operated machine for vending merchandise. Any suitable merchandise can be sold through a vending machine including foodstuffs such as snacks, soft drinks, and frozen novelties, etc., and non-edible items such as cigarettes, postage stamps, newspapers, and the like. The basic concept of the vending machine is that it contains an inventory of the particular merchandise and dispenses individual units of merchandise in response to product ordered along with the money deposited in the machine. A primary advantage to the vending machine is that it provides for the sale of merchandise in remote locations at all hours without requiring the presence of a sales person.

Customarily, each vending machine is visited on a periodic, routine basis by a service person who conducts an inventory of the product sold, replenishes the stock, checks the machine for any malfunctions, and retrieves the deposited money. Since each machine in each location will have a different vending history, some machines could be empty for considerable periods of time while others will be utilized only sporadically. Further, a malfunctioning vending machine creates a loss of goodwill, a loss of revenue, and increases the risk of vandalism to the machine by an angry customer. Ideally, the service frequency for each machine will occur just prior to the machine having vended all of its stock, regardless of the frequency of need.

A further expense that adversely affects the profitability of a vending machine service company is the excessive inventory requirements for the service person. In the absence of reliable information about the resupply needs of a particular vending machine, the service person must carry a full inventory of all merchandise sold through the vending machine so as to assure that no lost sales occur because of depletion of inventory between sales calls. However, the total excess inventory requirements for certain items such as food items can result in certain food items being held in inventory beyond the expiration date. Further, excessive handling of packaged merchandise along with the heat and vibration encountered in a delivery vehicle substantially reduces the expected shelf life of certain products.

System failure of certain types of vending machines such as those with refrigeration or freezer units is particularly crucial. For example, a vending machine for frozen novelty items can create several hundred dollars in damage if a failed freezer unit is not discovered for several days. The damage results not only from the loss of stock but also resultant damage from melted product inside the machine and to the surrounding flooring such as carpeting. The hidden costs from loss of goodwill from such an unforeseen accident can also be considerable.

The advantage created by the ability to place a vending machine in a remote, unattended location is also a major contributor to one of the primary causes of damage to the machine and that is either through vandalism or damage caused by unauthorized removal of money from the machine. Since a vending machine costs thousands of dollars, this type of damage can be considerable not only to the machine but also from the loss of inventory and money.

In view of the foregoing, it would be an advancement in the art to provide an inventory and security apparatus and method for monitoring a plurality of remotely located vending machines. It would also be an advancement in the art to provide a vending machine with a communication system coupled to a central location to enable a user of the vending machine to report a malfunction condition in the vending machine. Such a novel apparatus and method is disclosed and claimed herein.

BRIEF SUMMARY AND OBJECTS OF THE INVENTION

This invention is directed toward an apparatus and method for controlling and securing a plurality of vending machines located remotely from the central control. A telephone line interconnects each vending machine to a centrally located computer. Sensors in each vending machine detect the number and types of items dispensed, the amount of money collected, the quantity and type of change dispensed, problem conditions such as loss of electrical power, refrigeration malfunction, temperatures out of tolerance, vandalism, and the like. A communication link is also provided to enable a user to report a malfunction and for the security personnel in the central location to broadcast a message from the vending machine. The vending machine also has the ability to accept credit card charges and print receipts and even a menu for the user.

It is, therefore, a primary object of this invention to provide improvements in inventory and security apparatus for vending machines.

It is another object of this invention to provide improvements in the method of determining inventory of a vending machine at a remote location.

Another object of this invention is to provide a method for communication between a central location and a plurality of vending machines each of which is located at a discrete, remote location.

Another object of this invention is to provide each vending machine with a plurality of discrete sensors to sense items dispensed, money received, change dispensed, temperature, acts of vandalism, and the like.

These and other objects and features of the present invention will become more readily apparent from the following description in which preferred and other embodiments of the invention have been set forth in conjunction with the accompanying drawing and appended claims.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of the first preferred embodiment of a vending machine incorporating the novel features of this invention;

FIG. 2 is a perspective view of the vending machine of FIG. 1 shown with the front open to reveal the internal components; and

FIG. 3 is a schematic diagram of the inventory and security features of this invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The invention is best understood by reference to the drawing wherein like parts are designated by like numerals throughout in conjunction with the following description.

GENERAL DISCUSSION

The vending machine control apparatus and method of this invention is designed to accomplish a number of specific functions in addition to inventory control. These include credit card verification and receipt printing, security, and maintenance, including scheduled maintenance. Inventory control is an important aspect of this system since it provides to the service person a current listing of the products requiring replenishment while at the same time it provides an overview of the total vending system to identify those products having the best and worst sales histories at each location. With this information, the flow of products to the various vending machines can be very accurately controlled for increased profitability.

Reduced inventory is a goal most companies seek because it directly affects the profitability of the company. Further, if a delivery person is required to carry only the necessary resupply items and then only when required, numerous advantages result. For example, a smaller delivery vehicle is required to carry the specific resupply items, the resupply route can be accurately planned so as to service only those vending machines requiring service, and the delivery person will need to carry from the delivery vehicle to the vending machine only those items required to restock the vending machine.

Credit card use is increasing particularly for the purchase of items for which the cost substantially exceeds one dollar. While bill changers are common additions to most of the newer models of vending machines, they do not lend themselves well for accommodating the purchase of items costing several dollars. Also, bill changers reject worn or torn bills, and many people are accustomed to purchasing merchandise through the use of a credit card. Not only is a credit card safer to carry but it also provides the user with a printed history of purchases.

Clearly, the technology exists for the adaptation of a conventional credit card reader to a vending machine. Importantly, since each vending machine of this invention is coupled to a telephone line, it is a simple matter to process the credit card purchase automatically with this system. The processing step includes verifying the current status of the credit card and making the necessary electronic fund transfers to complete the sale.

A small, conventional printer is included in the vending machine to provide the customer with a printed copy of the transaction along with any other printed information such as menus, menu histories, ingredient listings, nutritional information, discount coupons, promotional items, and the like. Advantageously, the printer can be programmed to print most of the foregoing information even if the credit card system is not utilized.

Each vending machine is directly coupled by the telephone line to a central security monitor which is programmed to alert security personnel if sensors in the vending machine detect attacks or other apparently unlawful intrusions on the vending machine. For exam-

ple, a sharp, forceful blow to the vending machine will be sensed as vandalism while an attempt to pry open the locking mechanism will also be sensed and an alert signal passed to the security personnel.

Each vending machine is also equipped with a speaker/microphone combination in addition to a call button which enables the customer to communicate directly with the central security personnel. The speaker system also enables the security personnel to issue verbal warnings to persons in the vicinity of a vending machine undergoing a vandalism attack thereby helping dissuade the perpetrator from further damage to the vending machine. The two-way communication system also allows for prompt response to customer complaints, etc., and also provides for directing any required refunds directly to the address provided by the customer. Another advantage to the speaker system is that it can be programmed to verbally thank the customer or even provide verbal directions to the customer in the event of difficulty.

DETAILED DESCRIPTION

Referring now to FIGS. 1 and 2, a conventional vending machine is shown generally at 10 and includes a housing 12 and a front panel 14 hingedly joined to housing 12 by a hinge 16. Vending machine 10 can be any suitable vending machine for vending products such as frozen novelties, soft drinks, prepared meals, or the like. In the event vending machine 10 is used for refrigerated or frozen products it includes the appropriate refrigeration mechanism in a machine compartment 18 and a cold temperature chamber 20 behind an insulated, inner door 22. An outlet 24 delivers product (not shown) from cold temperature chamber 20 to a dispenser chute 26 in front panel 14.

An electrical power cord 15 supplies electrical energy to the various electrical systems in vending machine 15 from a conventional wall outlet (not shown). A telephone cord 13 provides the necessary communication link between vending machine 10 and the various control/communication systems described more fully hereinafter with respect to FIG. 3. Importantly, telephone cord 13 is provided as a conventional, armored telephone cord such as found on the handset to a pay telephone (not shown). This latter feature is important since it is through telephone cord 13 that the necessary protection and inventory control features of vending machine 10 are controlled.

Front panel 14 provides the support surface and enclosure for a selector 30, a credit card reader 40, a display screen 50, a bill changer 60 and a printer 70. Selector 30 includes a coin slot 32 and a change slot 34 with a plurality of adjacent selection buttons 36, all of which are conventional features of a coin-operated vending machine. The only difference is the inclusion of a coin box sensor 38 (FIG. 3) the function of which will be discussed more fully hereinafter.

Credit card reader 40 is essentially a conventional credit card reader and includes an insertion slot 42 and a keyboard 44 for entering the correct confirmatory code for the credit card (not shown) inserted into insertion slot 42. Screen 50 provides written instructions to the customer (not shown) in a manner somewhat analogous to the screen of an automatic teller machine. Coupled with credit card reader 40 and screen 50 is a printer 70 which not only prints a receipt for purchases with the credit card but also can be used to print coupons, promotional information, and the like.

Bill changer 60 is a conventional bill changer which is programmed to verify the authenticity of a the specific paper money (not shown) and then to allow the customer to select the desired product through selection buttons 36. Any change to be returned is discharged into coin return slot 62. Bill changer 60 is directly linked to an alarm system 66 (FIG. 3), the function of which shall be discussed more fully hereinafter.

A speaker 80 includes an integral microphone 82 and can be activated by depressing a call button 84 adjacent credit card reader 40. Speaker 80 can be activated independently by security and/or maintenance personnel as will be discussed more fully hereinafter. Speaker 80 provides for the delivery of background music, if desired, messages, advertisements, or audible instructions for the use of the various components of vending machine 10. Importantly, speaker 80 in combination with microphone 82 serves as a communication link for the customer. Speaker 80 can also be used to deliver warning messages to persons tampering with or otherwise attempting an unlawful activity with vending machine 10.

It should be noted that each of selector 30, credit card reader 40, display screen 50, bill changer 60, printer 70, and speaker 80 are shown as separate units for ease of illustration. Clearly, the technology currently exists whereby each of these units can be incorporated into the same housing which would be substantially smaller than the combined space taken up by each of these units as shown. This latter feature is important in that it means that a conventional vending machine can be retrofit with the novel system of this invention.

Referring now also to FIG. 3, the schematic for the novel security and inventory apparatus and method of this invention is shown generally at 100 and includes a security station 102, a maintenance control station 104, a comptroller station 106, and an inventory control station 108 interconnected by a central computer 110 to vending machine modem 11. Central computer 110 is specifically configured to be coupled with a plurality of vending machines 10 although only one is shown for ease of illustration. Telephone line 13 provides the communication link between vending machine modem 11 and central computer 110 and also provides the direct link of speaker 80 and microphone 82 with security station 102 and maintenance control station 104. As illustrated, telephone line 13 is shown separately for ease of presenting the foregoing concept of direct linkage although it is the same telephone line.

During normal operation, vending machine modem 11 acts as the relay device for transmitting transactional information between the various systems in vending machine 10 and the central computer. For example, referring also to FIGS. 1 and 2, a customer (not shown) will place the appropriate paper money into dollar bill changer 60 or a credit card into credit card reader 40 prior to making a selection with selector 30. Change, if any, is delivered through a change slot 34 and the item of merchandise is delivered to dispenser chute 26. Simultaneously, inventory sensor 94 electronically records the transaction and stores the accumulated inventory information for subsequent transmittal to inventory control 108. The monies received are likewise recorded electronically by dollar bill changer 60 and coin box 38 and transmitted via vending machine modem 11 and central computer 110 to comptroller 106.

A customer using credit card reader 40 inserts an appropriate credit card along with the personal encod-

ing information. Central computer 110 verifies the authenticity of the credit card and the authorization code thereby activating vending machine 10 to deliver the merchandise selected at selector 30. Simultaneously, a receipt is printed by printer 70 while controller 106 records the transaction and inventory control 108 records the merchandise sold and deducts the same from the inventory record of vending machine 10.

At all times a visual message can be displayed on screen 50 not only to impart operating instructions to the consumer but also to carry merchandise advertising as well as paid advertising for products or services remote from the merchandise sold through vending machine 10. Speaker 80 can also be used in conjunction with screen 50 to transmit the foregoing or supportive information verbally.

Security for vending machine 10 is supplied by several features among which are impact sensor 92 and alarm 86. Impact sensor 92 is designed to sense untoward motion such as sharp blows, tilting, or the like. Even an unauthorized attempt to move vending machine 10 will result in impact sensor sending an alarm signal via alarm 86 and vending machine modem 11 to central computer 110. The resulting alarm signal is then sent to security 102 where the appropriate response is initiated. One response will be for security 102 to alert the local police, building security, or even the building maintenance personnel in the building where vending machine 10 is located. Simultaneously or separately, as the case may be, security 102 can activate either or both of microphone 82 and speaker 80. Through microphone 82 security 102 can listen to the ambient sounds around vending machine 10 and thereby possibly obtain sufficient information to enable security 102 to initiate the appropriate action. One such action would be to broadcast the appropriate verbal message through speaker 80. In most instances such a verbal message should be sufficient to deter further attacks on vending machine 10. If such deterrence is ineffective, the appropriate law enforcement or security personnel can be alerted to the problem giving the precise location of vending machine 10.

Alarm 86 is also coupled to bill changer 60 and coin box 38 as well as door 14 so as to initiate alarm signals in the event there is an unlawful attempt to break into vending machine 10. This is particularly important since vending machine 10 may contain considerable amounts of cash and is generally placed at a remote location. As before, alarm 86 transmits the alarm signal via vending machine modem 11 to central computer 110 where the alarm signal is forwarded to security 102. Any of the above-described responses can be initiated by security 102. Advantageously, once it is learned that the unlawful entry to vending machine 10 results in a high capture rate of persons engaged in such unlawful activities, there should be a significant drop in the number of such incidents perpetrated against vending machine 10 in the future.

Machine condition sensors 90 are configured to detect selected machine conditions such as temperatures outside the temperature ranges specified, refrigeration system failure, or failure of any other selected system in vending machine 10. Depending upon the seriousness of the particular system failure, alarm 86 will either store the specific information electronically or, in the most probable circumstance, transmit this information directly to central computer 110 via vending machine modem 11. Central computer 110 routes the informa-

tion to maintenance control for action. Maintenance control can then initiate the appropriate response which can range between placing the information on the instruction printout for the route service person for routine action or initiate an immediate service response.

Machine condition sensors 90 are also programmable to act as a process control system if vending machine 10 is used to vend a consumable item such as a frozen entree (not shown), or the like, and the item requires a second or third step prior to delivery of the item to the purchaser. For example, if vending machine 10 is used for vending hot meat pies (not shown) stored in the frozen state in cold temperature chamber 20, the programmable features of machine condition sensors 90 enable it to retrieve the frozen meat pie and transfer it to a microwave oven (not shown) where the meat pie is defrosted and heated to the proper temperature for that particular meat pie. Thereafter, the hot, meat pie is delivered to dispenser chute 26.

Inventory sensor 94 is configured to be interrogated periodically by central computer 110 via vending machine modem 11 to update inventory control 108 with the current status of the merchandise inventory in vending machine 10. Advantageously, this information can be obtained over telephone line 13 during periods of low telephone rate charges, and, since the information is transmitted electronically, the actual line time is relatively brief thereby providing significant savings.

Perhaps the greatest cost savings realized through vending machine 10 are from the improved inventory control achieved through inventory control 108. In particular, the service person (not shown) is provided with a precise route for servicing vending machines 10 at each specific location. The servicing instructions will specify the types and quantities of the specific merchandise to be put into each machine along with the amount of change to be placed in the coin changer portion of selector 30. Additionally, the routing instructions will carry any repair and maintenance instructions for vending machine 10. Importantly, the service person (not shown) is thereby able to more efficiently service more vending machines 10 more quickly with unnecessary trips with excess inventory virtually eliminated. One specific advantage is that the service person knows in advance what is required for a visit to a specific vending machine. This means that only the necessary restocking merchandise need be carried from the delivery vehicle to vending machine 10. Also, if any tools, cleaning supplies, or the like are required, the route instructions contain such information so that the time saved by the service person is significant.

Another advantage to inventory control 108 is that it can readily supply a continuous flow of sales information about merchandise dispensed through vending machine 10. This is important since it allows the operator (not shown) to maximize sales of merchandise through vending machine 10 by concentrating high-demand merchandise into vending machines 10 where the most units of that specific merchandise is being sold. Correspondingly, slow moving merchandise can also be identified and even eliminated entirely from the system. This latter feature is particularly advantageous in light of the fact that very little excess inventory is held in storage and none is carried on the delivery vehicles so that it is relatively inexpensive to discontinue a particular line of merchandise.

Significantly, the introduction of a new product can be test marketed relatively inexpensively through vend-

ing machine 10. In particular, the new product can be advertised over speaker 80 and screen 50 while sales of the same can be accurately monitored not only by the physical location of vending machine 10 but also by continuous monitoring by inventory sensor 94 in combination with central computer 110 to provide a running inventory of sales by time of day. Additionally, printer 70 can be used to print rebate slips, coupons, and the like as a further means of identifying consumers and their response to the particular merchandise being dispensed by vending machine 10.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

What is claimed and desired to be secured by United States Letters Patent is:

1. A monitor system for a remote vending machine comprising:

an electronic monitor means operable to receive signals from a remote vending machine;

communication means for transmitting electronic signals between said electronic monitor means and said remote vending machine, said communication means including a speaker mounted on said vending machine to permit audible messages to be communicated from said electronic monitor means to a customer in the vicinity of said vending machine and a call switch and a microphone to enable said customer to communicate verbally and directly with a person at a location remote from said vending machine, said communication system comprising an alarm means for signaling said electronic monitor means when an alarm condition is experienced by said vending machine, said microphone being independently operable to enable security personnel to listen to ambient sounds adjacent said vending machine during said alarm; and

inventory sensing means in said vending machine for sensing the inventory of said vending machine and transmitting electronic signals to said electronic monitor means as a function of said inventory.

2. The monitor system defined in claim 1 wherein said communication means includes verification and acceptance means for credit cards to thereby verify the validity of a credit card and then accept the credit card as a means of payment for a product purchased from said vending machine.

3. The monitor system defined in claim 1 wherein said alarm means comprises a first alarm sensor means for sensing a system malfunction in said vending machine.

4. The monitor system defined in claim 1 wherein said alarm means comprises a second alarm sensor means for sensing excessive force imparted to said vending machine, said excessive force being interpreted by said electronic monitor means as either vandalism to said vending machine or an attempted unlawful entry of said vending machine.

5. The monitor system defined in claim 1 wherein said electronic monitor means includes an inventory control means for providing a service order for said vending machine as a function of said electronic signals received from said inventory sensing means.

6. The monitor system defined in claim 1 wherein said inventory sensing means comprises continuous inventory sensing means for providing continuous information about the inventory in said vending machine.

7. The monitor system defined in claim 1 wherein said communication means includes a machine condition sensor means for sensing the condition of said vending machine and transmitting said electronic signals representative of said vending machine condition to said electronic monitor means.

8. The monitor defined in claim 1 wherein said communication means comprises a display screen on said vending machine for displaying a visual message on said vending machine.

9. A monitor system for a remote vending machine comprising:
sensor means in said vending machine for selectively sensing and generating electronic information about machine conditions, inventory status, and alarm conditions;
transmitting means for transmitting to a central location said electronic information from said sensing means;
communication means for allowing a first person at said central location to communicate with a second person at said vending machine, said communication means including microphone means and speaker means for allowing said second person to speak directly with said first person at said central location;
inventory control means for monitoring said inventory status to provide an inventory record for said vending machine; and
alarm means for transmitting an alarm when an alarm condition is sensed in said vending machine.

10. The monitor system defined in claim 9 wherein said communication means includes credit card verification means for verifying the authenticity of a credit card.

11. The monitor system defined in claim 10 wherein said communication means includes a printer means for

printing information to be taken by a customer of said vending machine.

12. The monitor system defined in claim 10 wherein said communication means includes a display screen means for visually displaying information.

13. A method for monitoring a vending machine at a remote location comprising:

providing said vending machine with an alarm means for sensing an alarm condition in said vending machine;

mounting an inventory sensing means in said vending machine for sensing the inventory condition of said vending machine;

incorporating a communication means in said vending machine, said communication means comprising a speaker, a microphone, a display screen, and a printer;

placing a money receiving means in said vending machine, said money receiving means comprising a credit card verification means for verifying the authenticity of a credit card, a coin changer and a bill changer;

coupling said vending machine to a central computer means with a telephone line, said central computer means monitoring said alarm means, said inventory sensing means, and said money receiving means; and

protecting said vending machine by directly coupling said vending machine through said alarm means to a security means thereby providing security to said vending machine, said protecting step including selectively operating said microphone independently to enable security personnel to listen to ambient sounds with said microphone during said alarm condition.

14. The method defined in claim 13 wherein said coupling step includes monitoring said central computer means for obtaining information about the current inventory status of said vending machine.

15. The method defined in claim 13 wherein said method includes monitoring machine conditions in said vending machine including delivery of products purchased from said vending machine.

* * * * *

EXHIBIT C

U.S. PATENT NO. 6,418,416 TO ROSENBERG, ET AL.

(12) **United States Patent**
Rosenberg et al.

(10) Patent No.: **US 6,418,416 B1**
 (45) Date of Patent: **Jul. 9, 2002**

(54) **INVENTORY MANAGEMENT SYSTEM AND METHOD**

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(73) Assignee: **SupplyPro, Inc., San Diego, CA (US)**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/476,536**

(22) Filed: **Jan. 3, 2000**

Related U.S. Application Data

(60) Provisional application No. 60/127,567, filed on Apr. 2, 1999.

(51) Int. Cl.⁷ **G06F 153/00**

(52) U.S. Cl. **705/28; 705/22**

(58) Field of Search **705/28, 29, 23, 705/22, 26; 221/10, 12, 28; 312/215; 707/3, 9**

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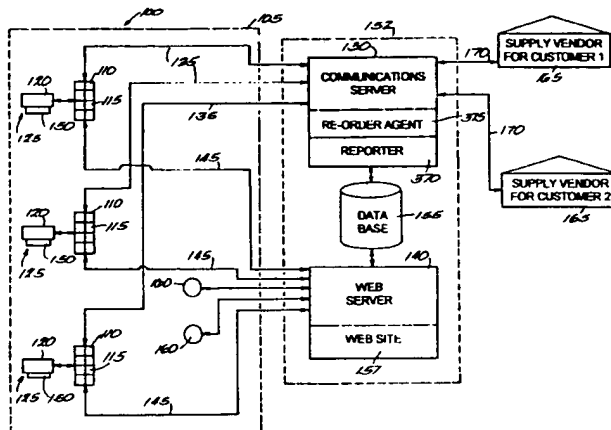
Primary Examiner—Douglas Hess

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(57) **ABSTRACT**

A method and system of dispensing items in a controlled manner from cabinets or similar enclosures, re-ordering the dispensed articles or items, and providing inventory and other information about the items and users in the system. The invention utilizes a distributed network and permits users to browse and search for any item across multiple enclosures from any location. The method and system can track inventory, generate administrative reports, and independently initiate orders based on aggregate inventory levels of multiple enclosures to gain the benefit of volume discounts, minimize deliveries, maximize availability of items, or generate individual orders based on specific enclosures to maintain just-in-time inventory levels. The method and system also track the removal and stocking of items through unique identification strings, so that individual access, use, and theft of items can be monitored.

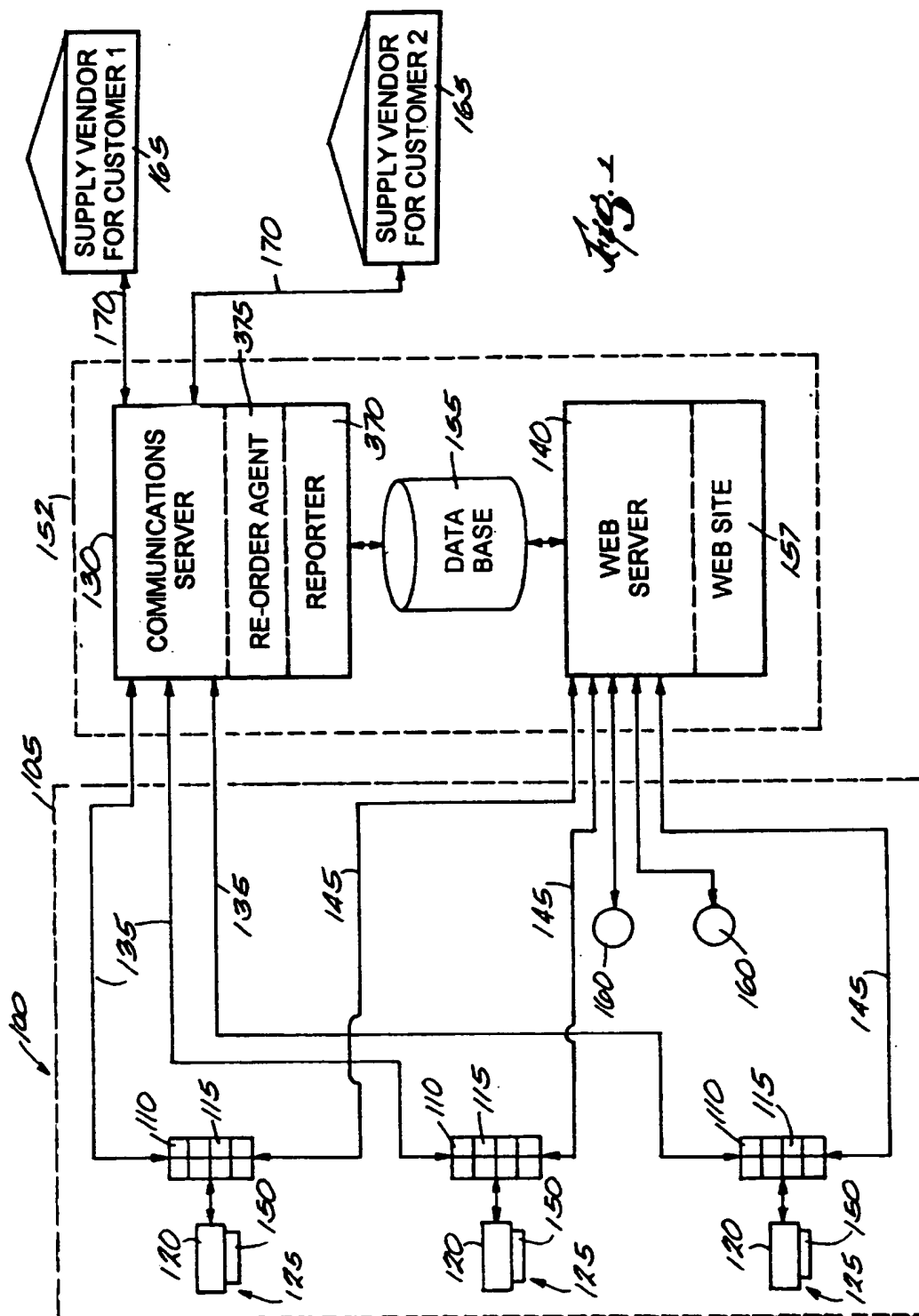
32 Claims, 17 Drawing Sheets

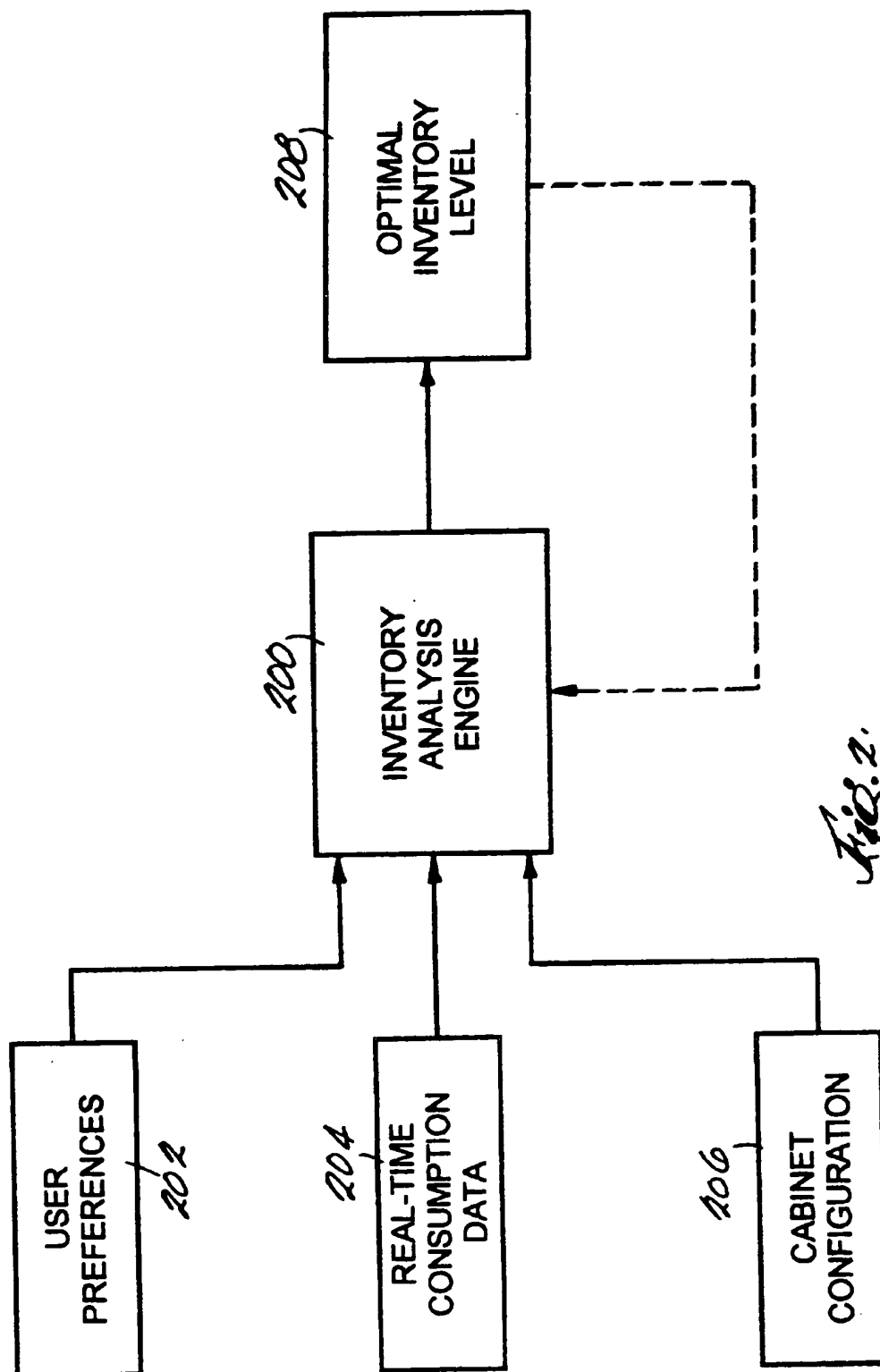


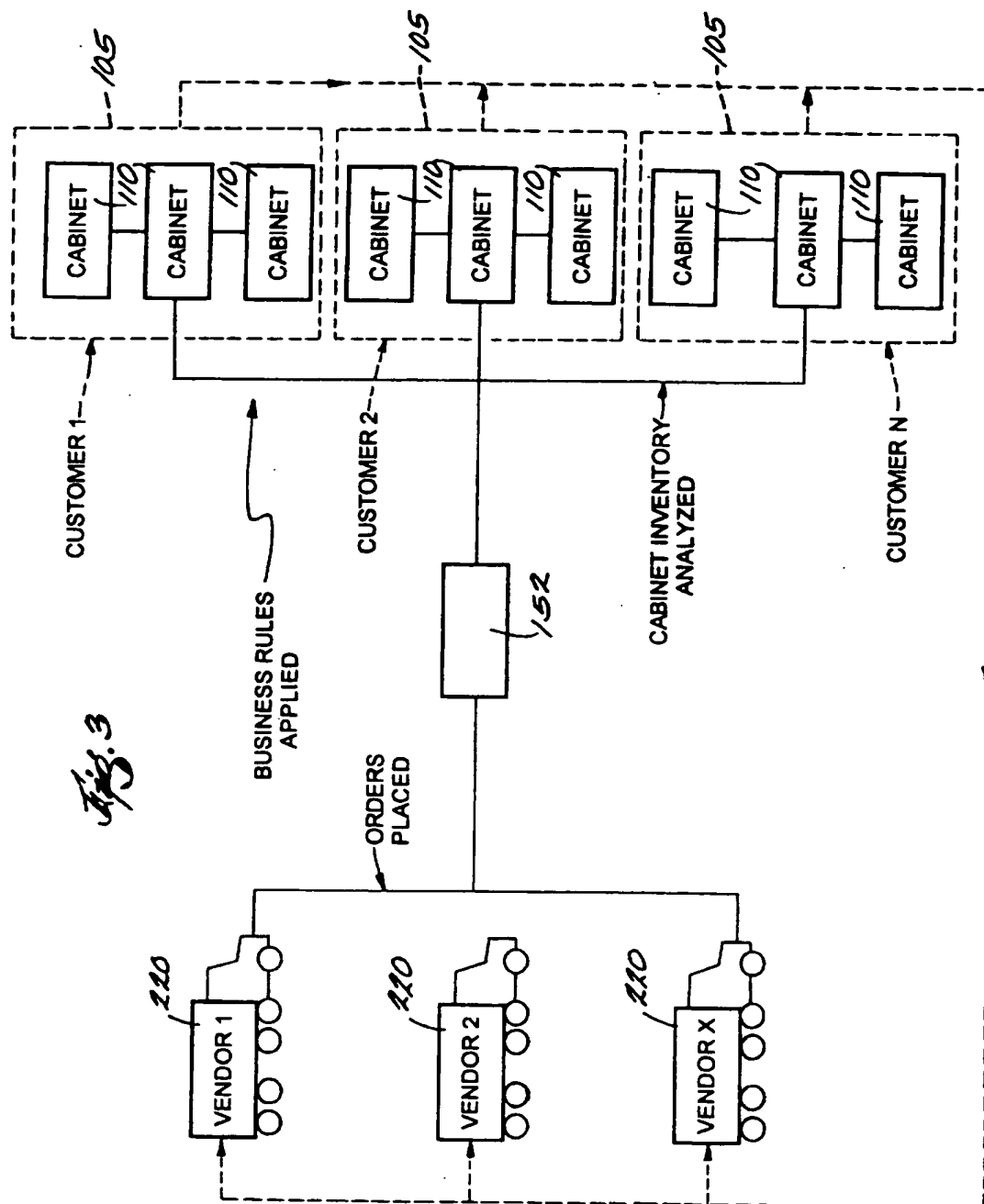
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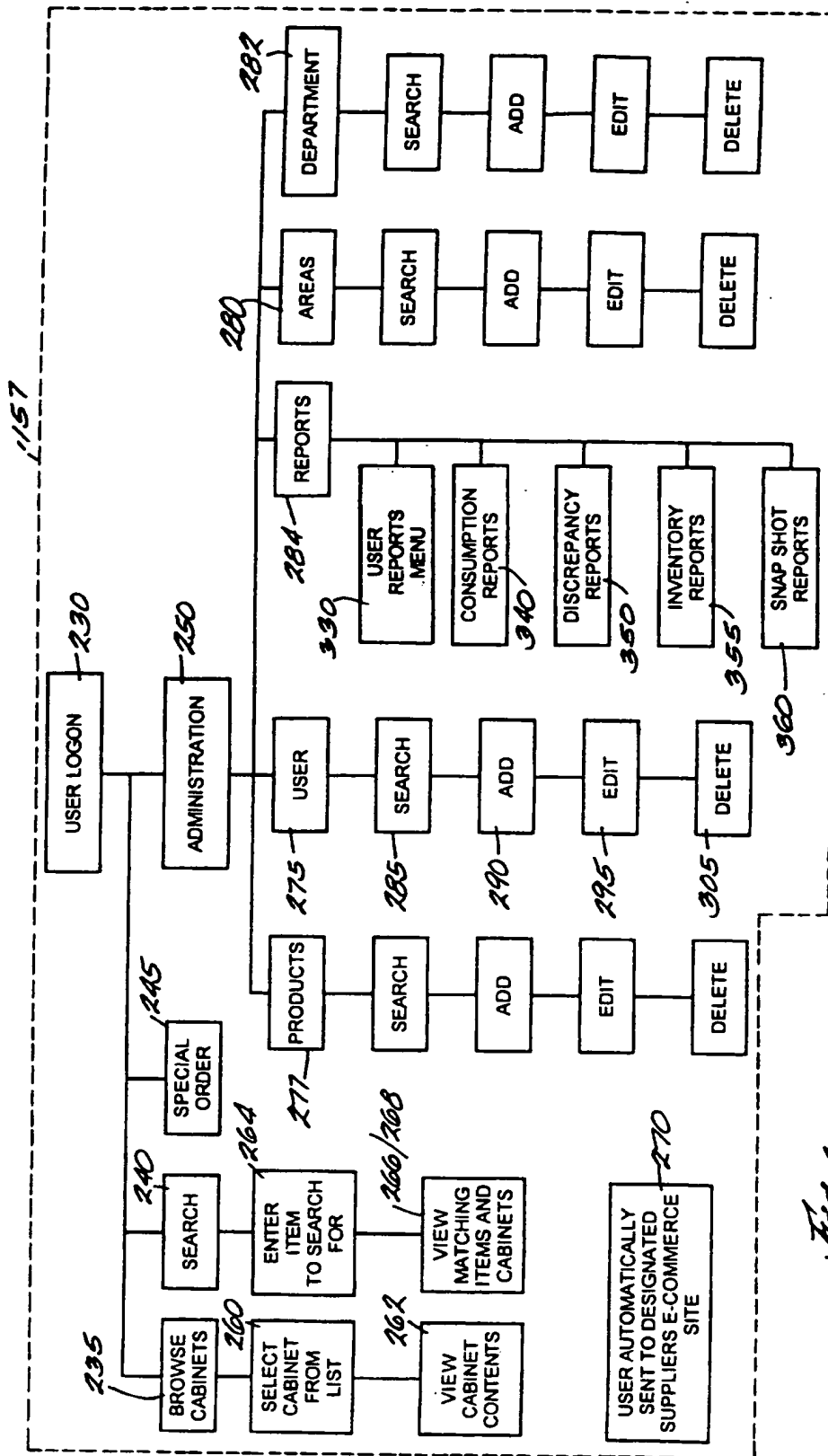


Fig. 4

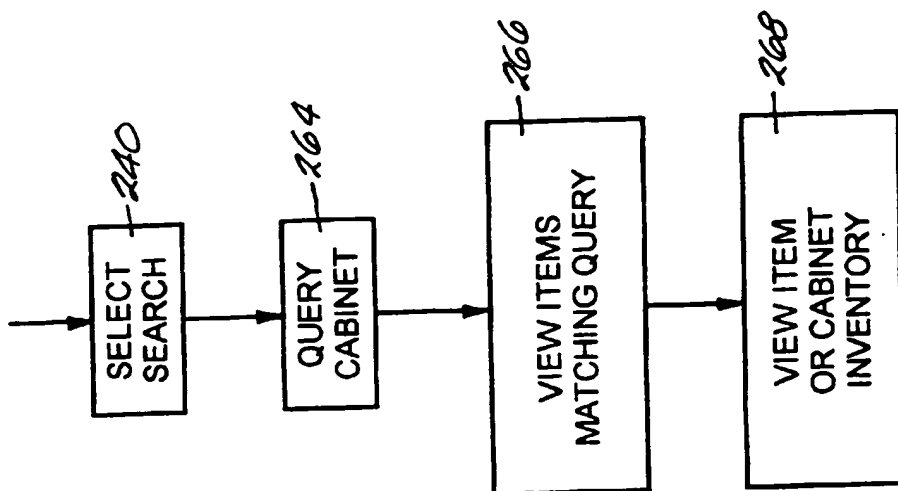


Fig. 6

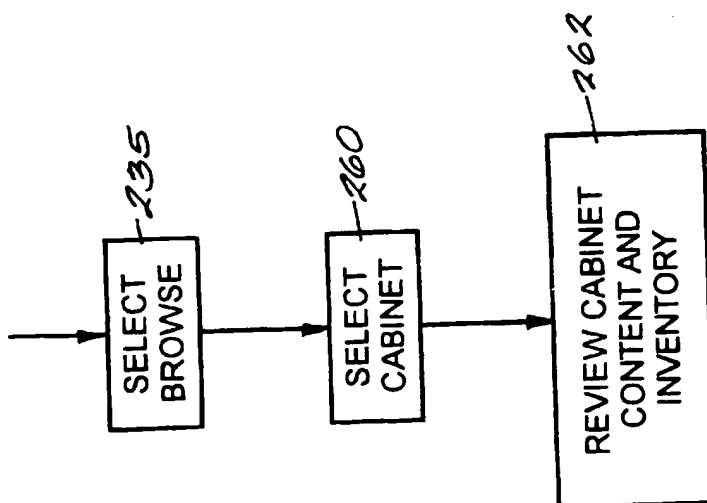
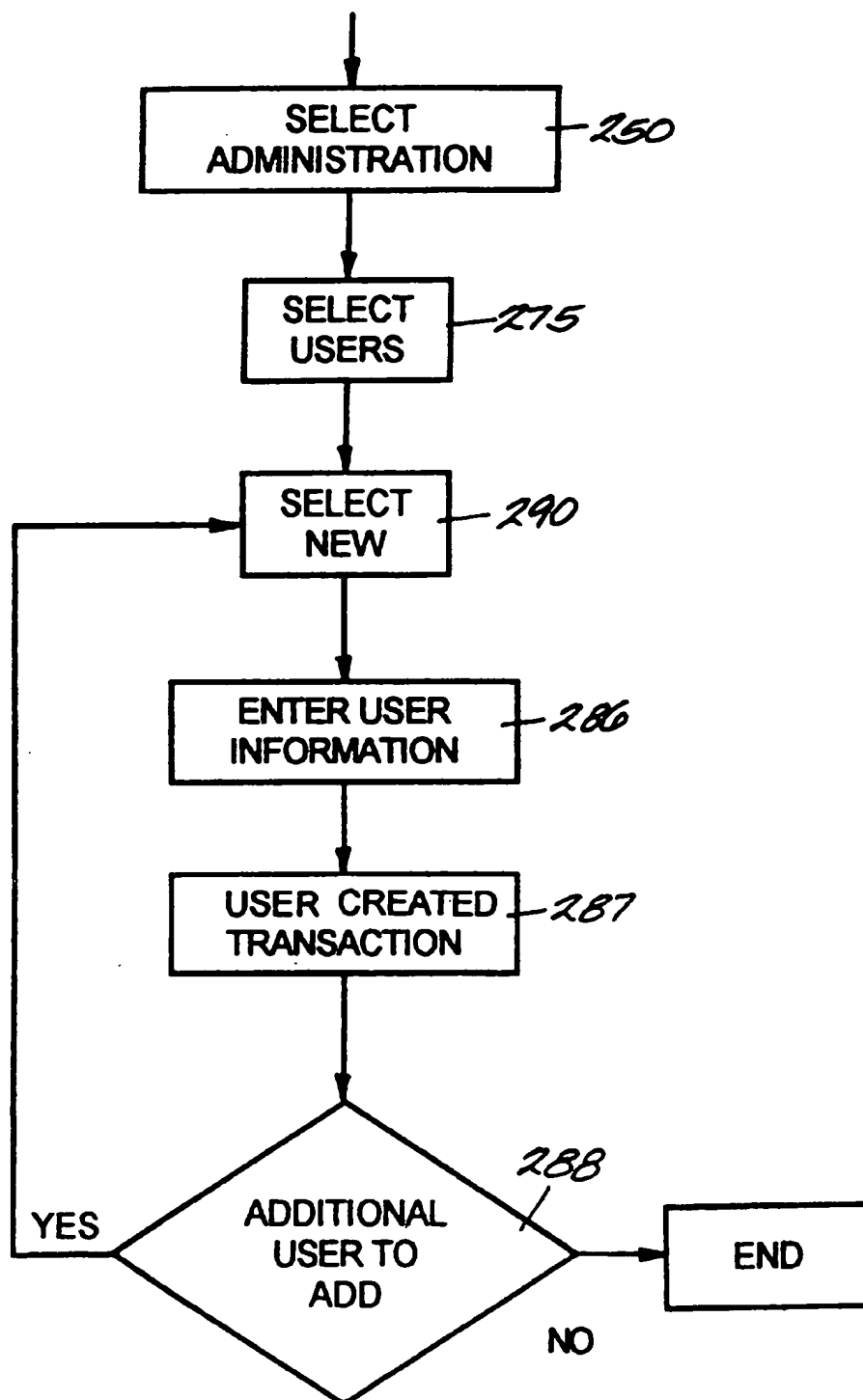
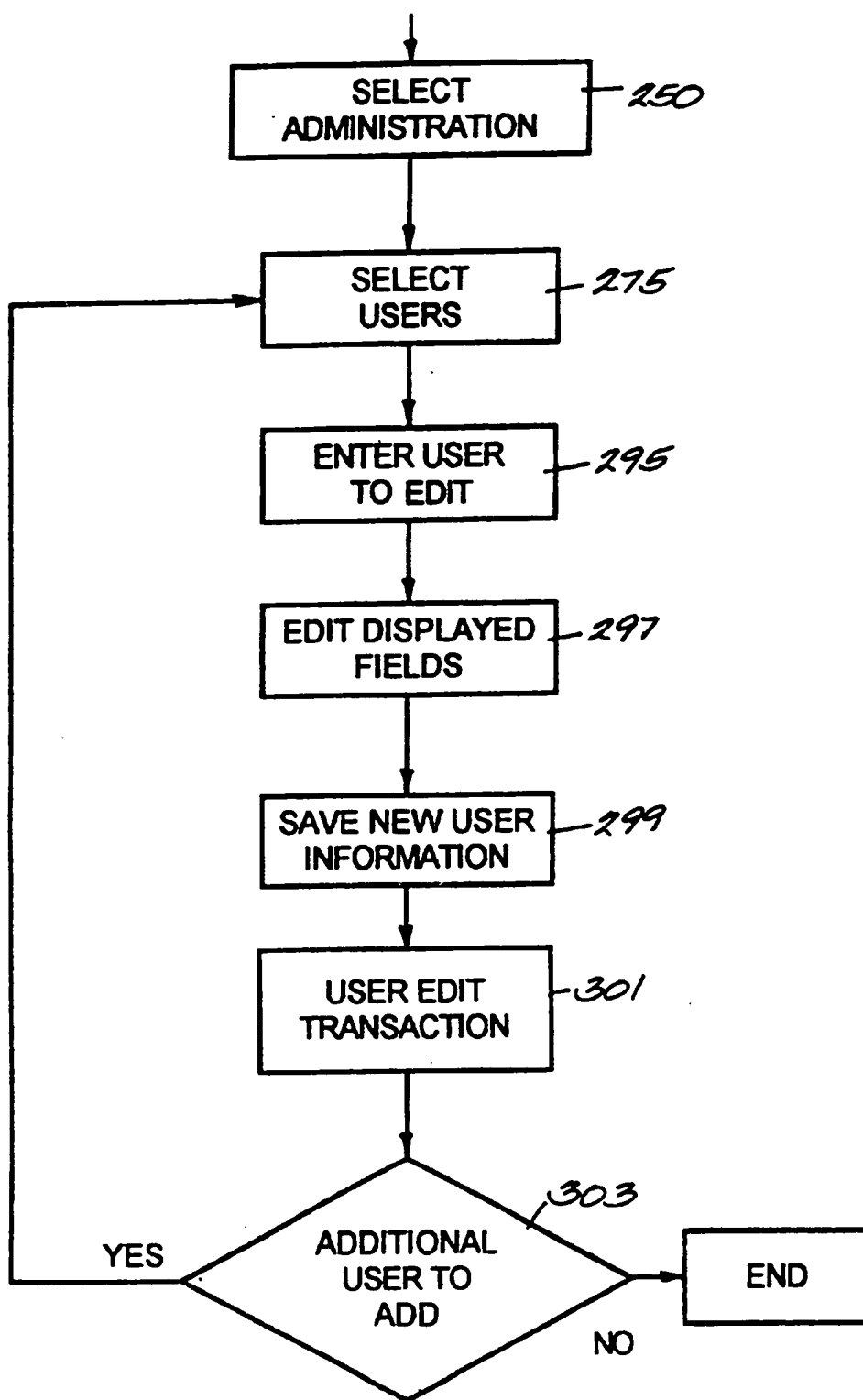
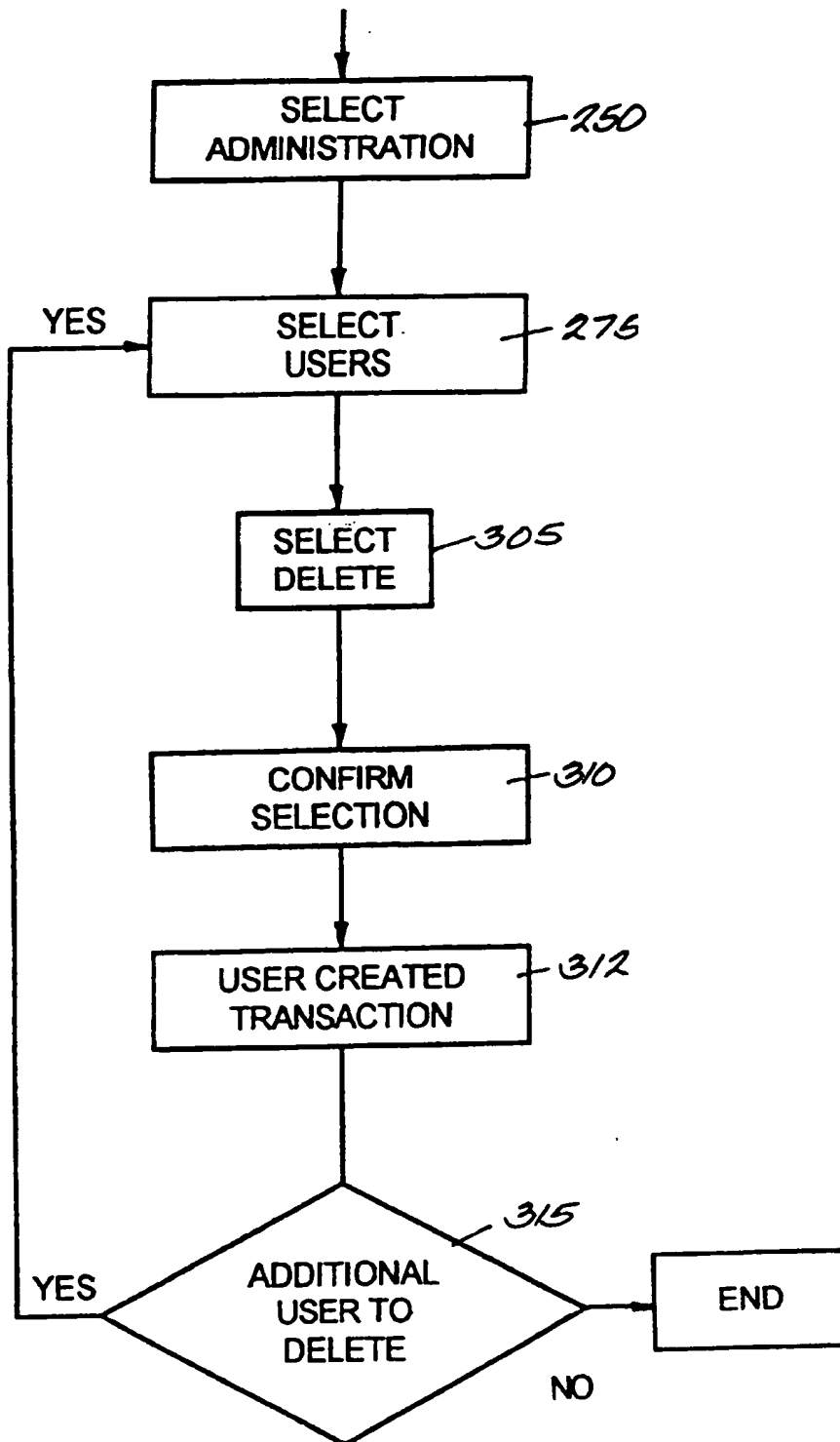
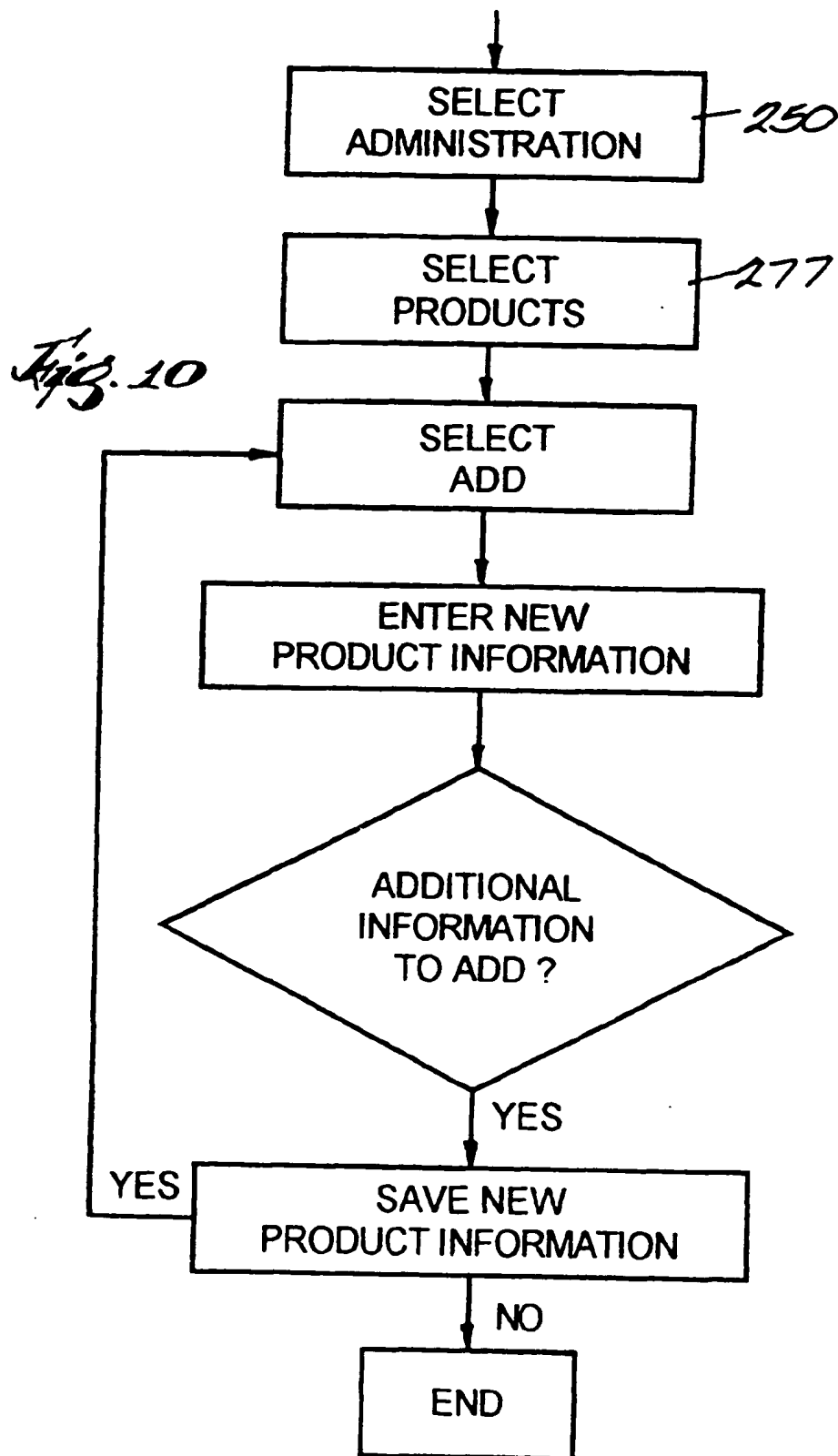


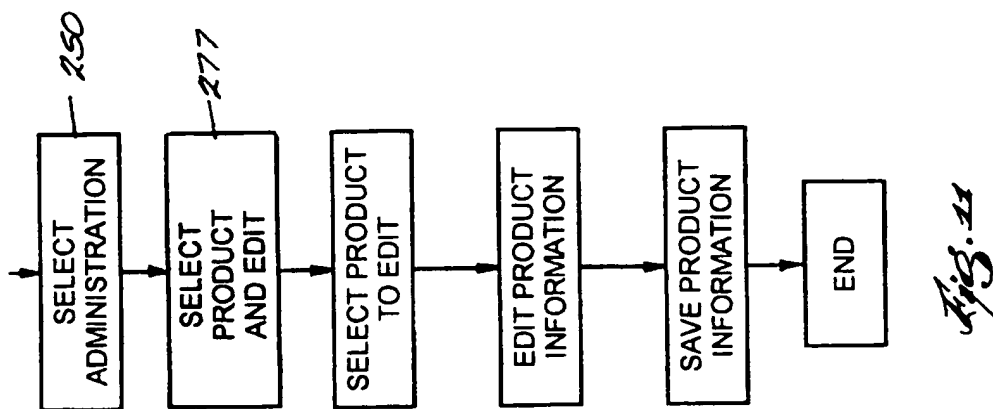
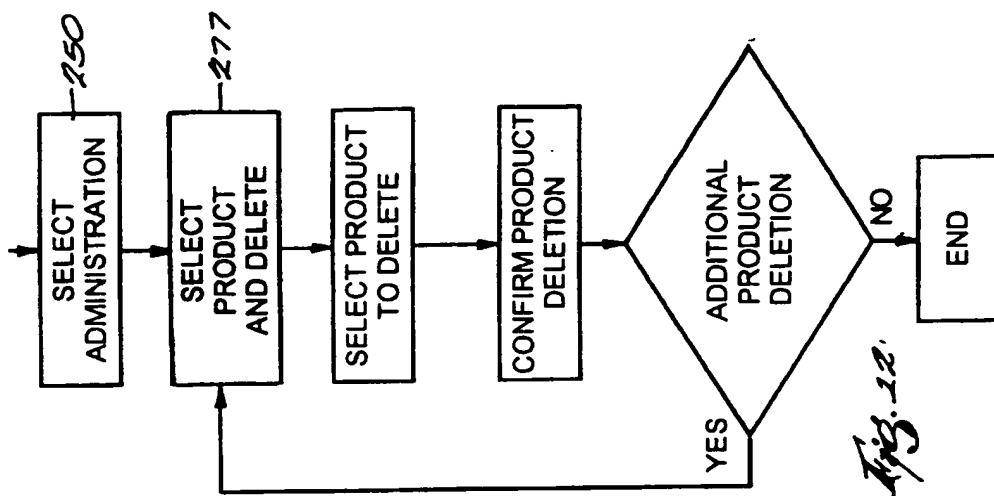
Fig. 5

*Fig. 1*

*Fig. 8*

*Fig. 2*





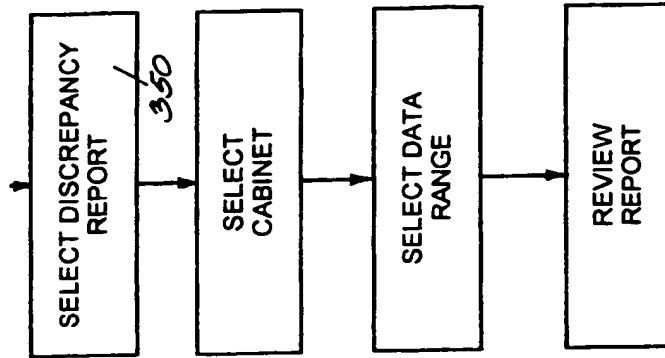


Fig. 15

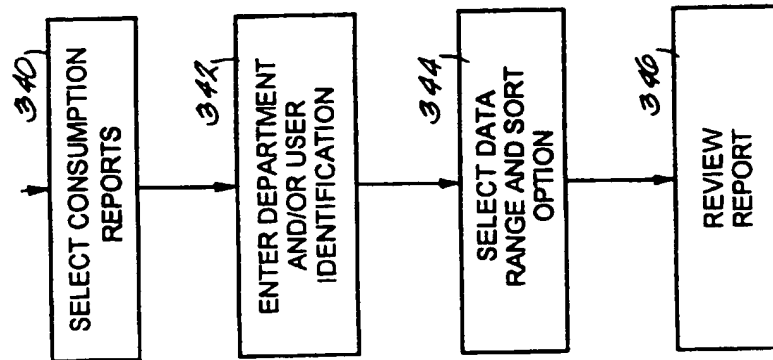


Fig. 14

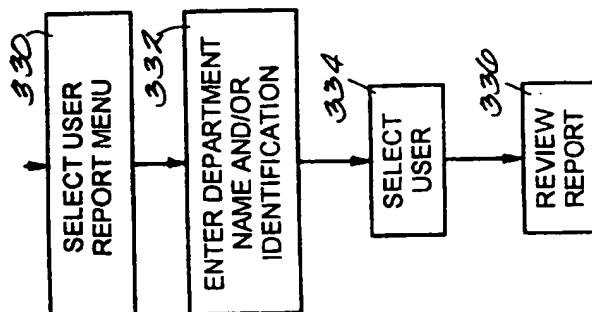
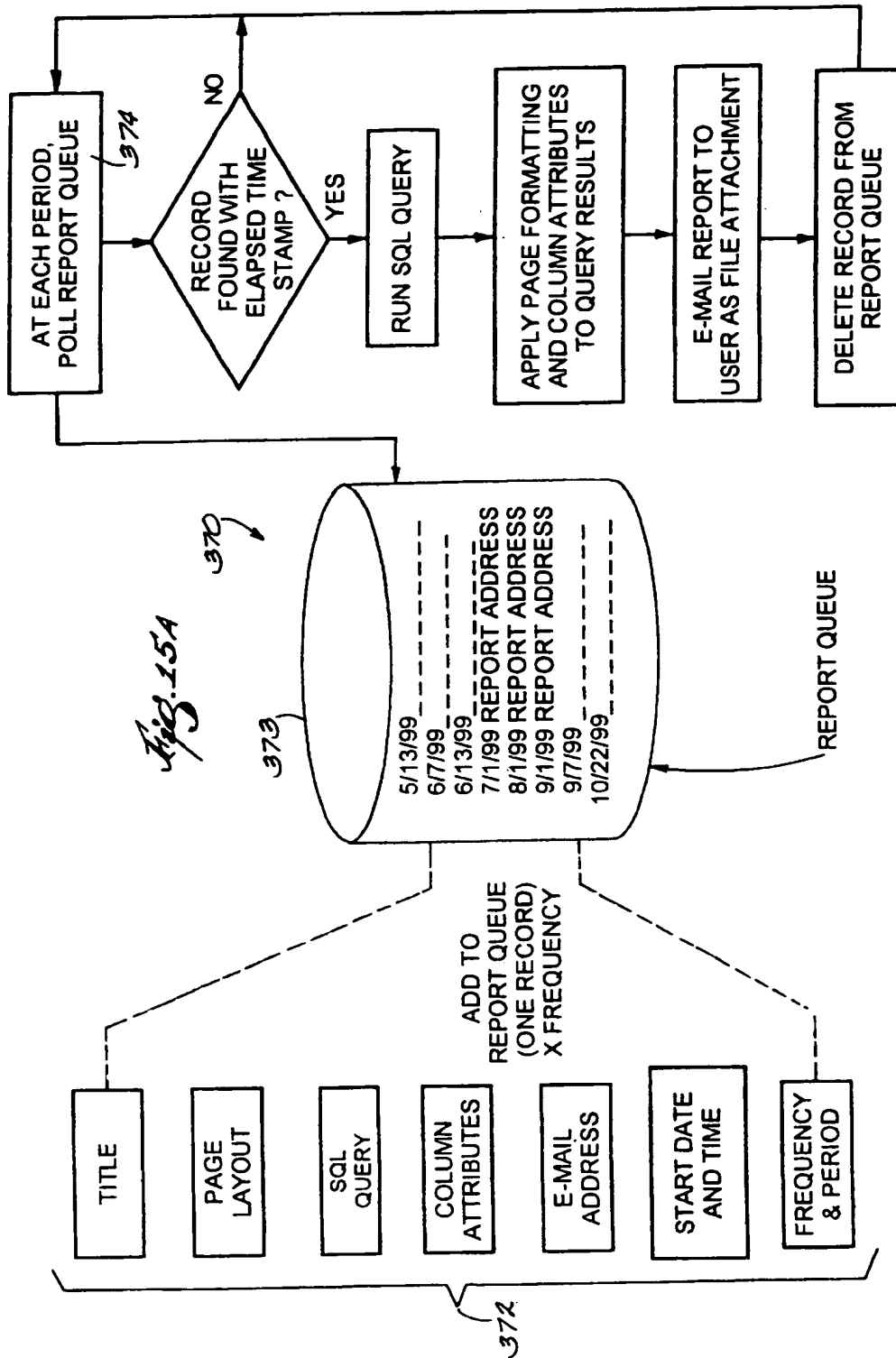
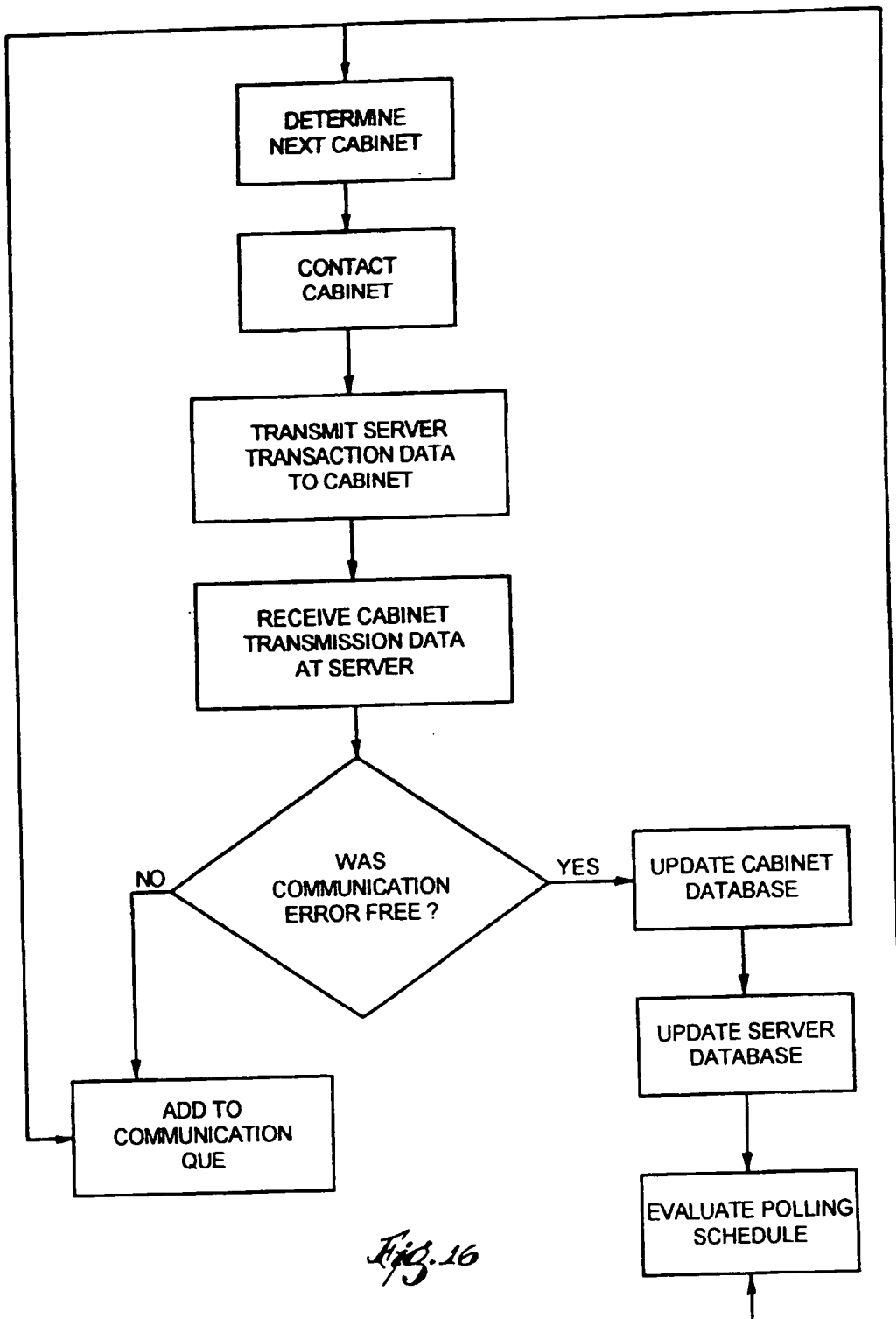


Fig. 13



*Fig. 16*

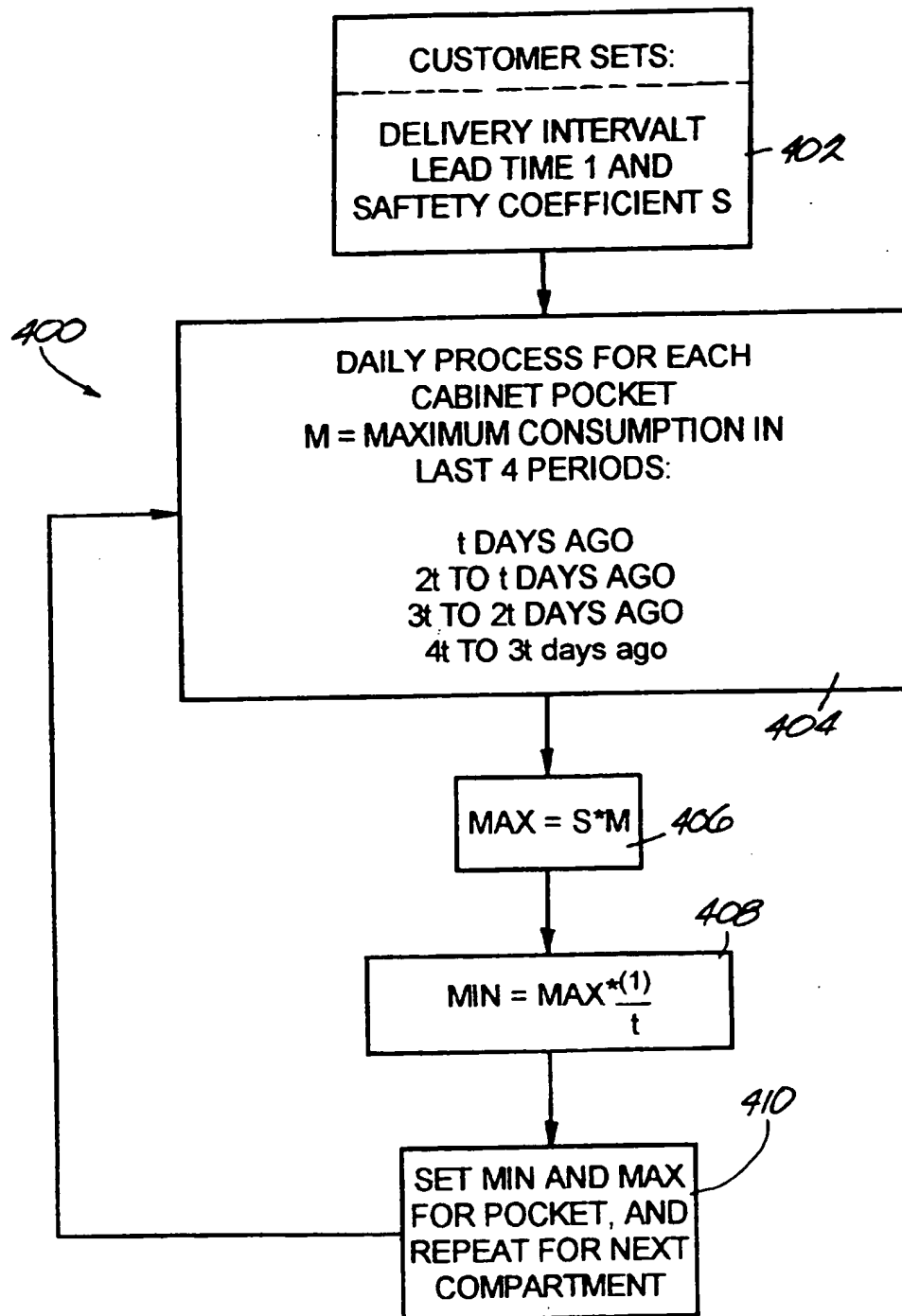
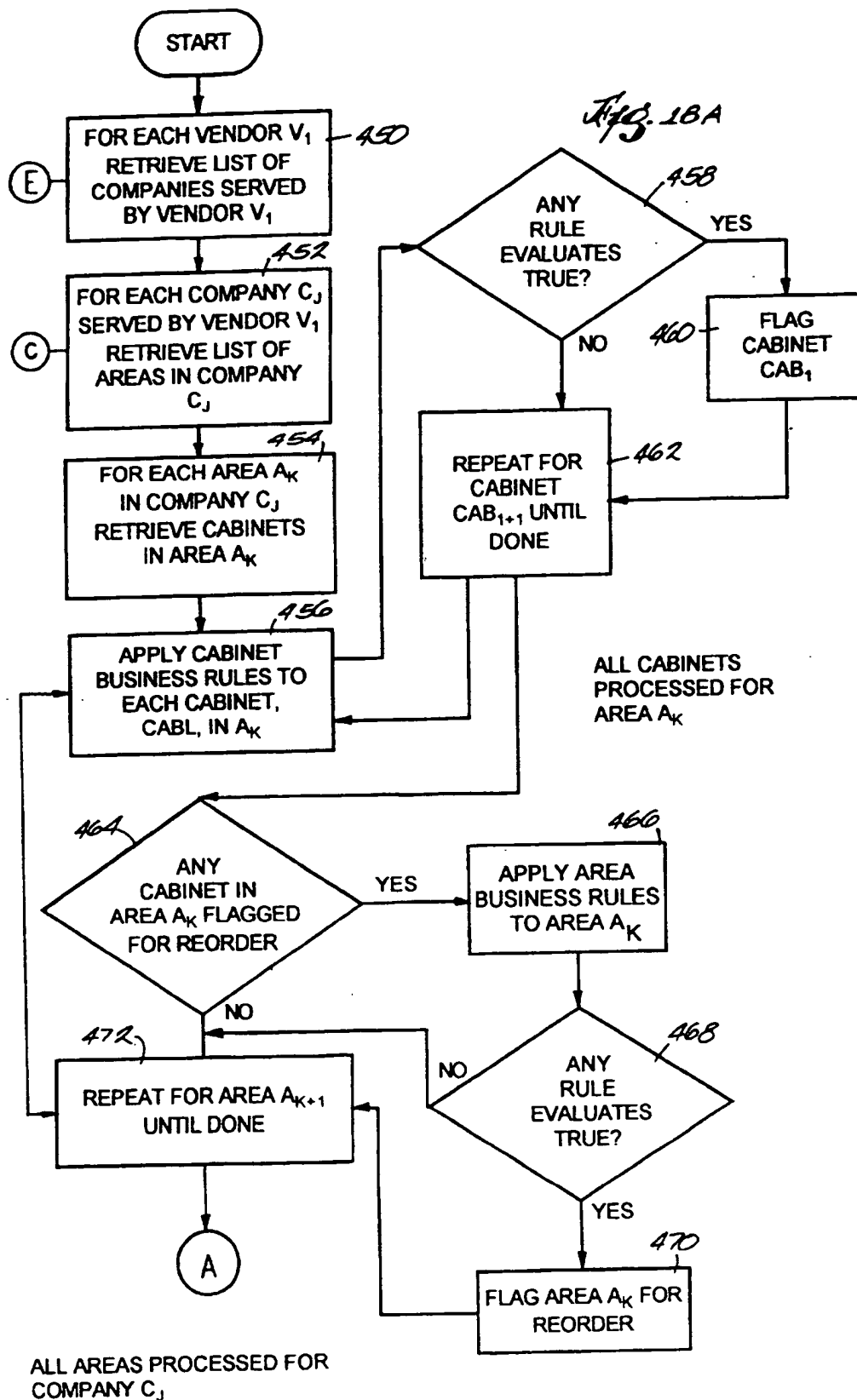
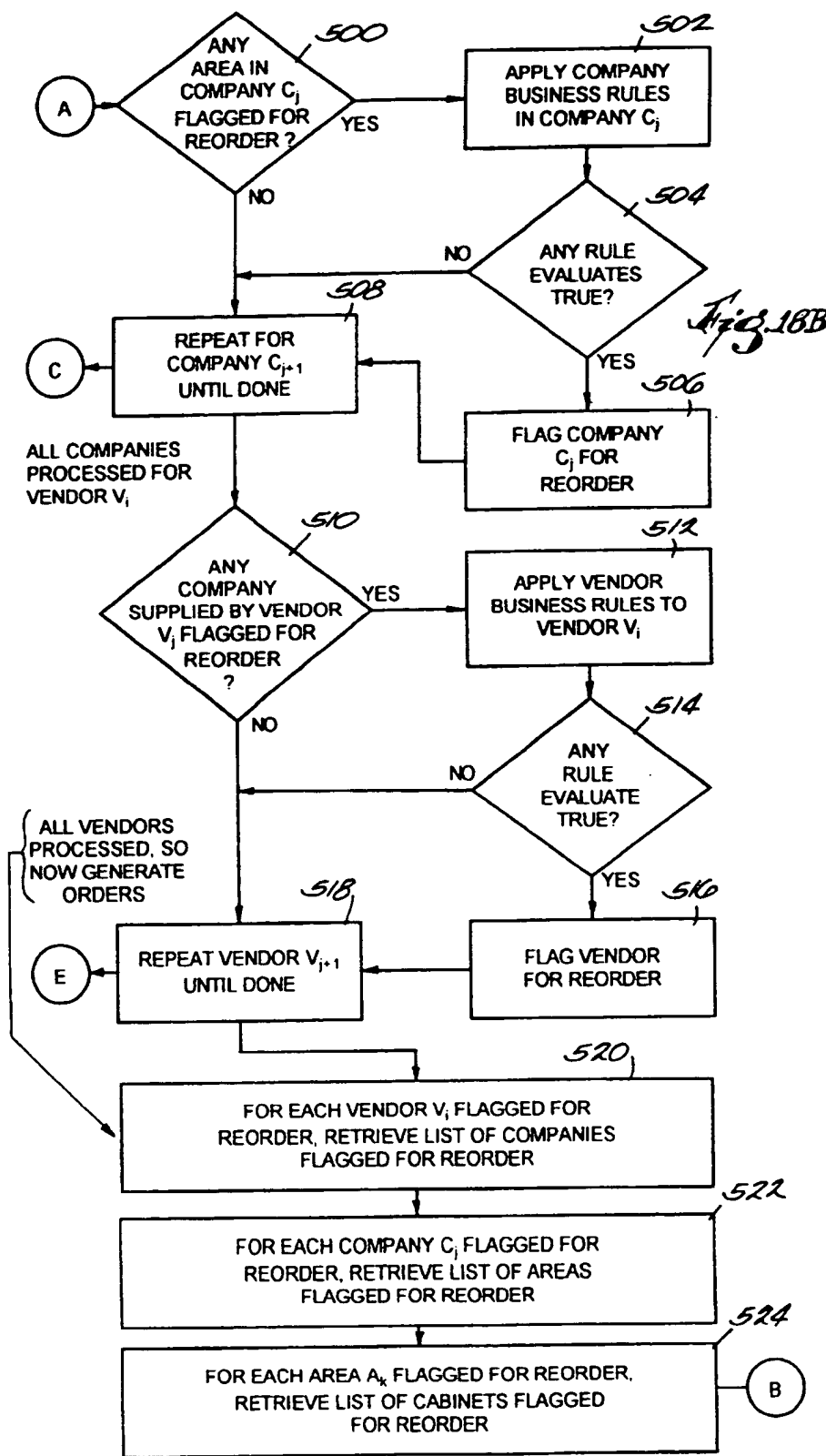
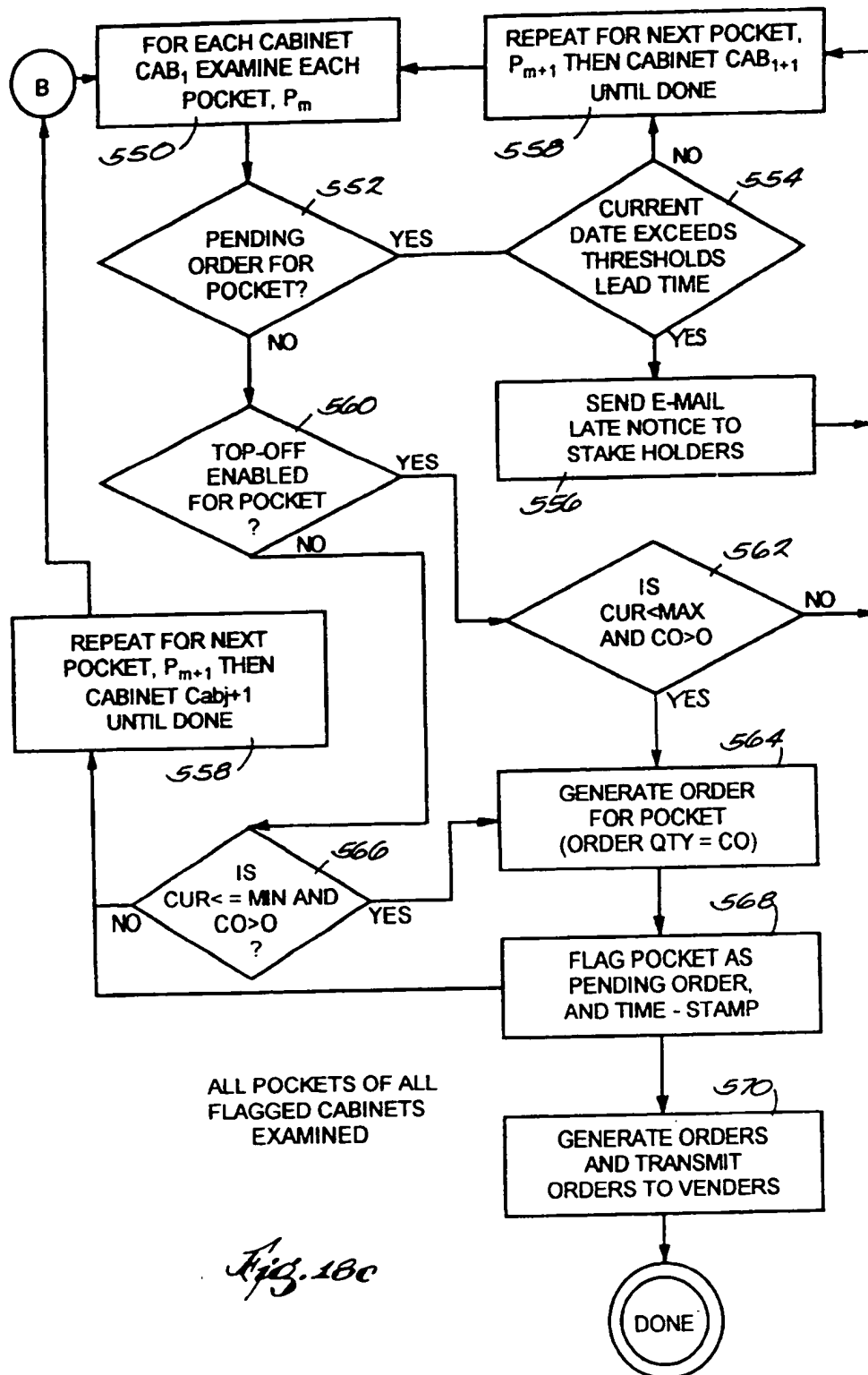


Fig. 17







INVENTORY MANAGEMENT SYSTEM AND METHOD

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority under 35 U.S.C §119 to Provisional Patent Application Ser. No. 60/127,567, filed Apr. 2, 1999.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to methods and systems for dispensing supplies and similar items in a controlled manner. More particularly, the present invention relates to a method and a system that provides distributed access to product and inventory information for supplies and that generates orders when supplies need to be re-ordered.

2. Background of the Invention

Distributed networks are characterized by a structure where processing, storing, and other functions are carried out by separate nodes rather than on a single main or centralized computer. The Internet is one example of a distributed network and, as is well known, it provides access to a wide array of information. The World Wide Web portion of the Internet provides a graphical, interactive medium that permits businesses to advertise and take orders for goods and services.

The variety of products and services available for sale through the Internet is tremendous. Some sites offer a full range of business supplies ranging from office furniture and computers to envelopes and pencils. However, these sites are often no more than electronic catalogs and some require separate computers, navigation software, and online addresses to shop online. Further, the typical electronic store does not assist users in selecting the right business supply inventory mix, track business supply use, or focus on users' needs to maximize efficiency and economic return. Further still, distributed networks such as the Internet have not, in general, been fully exploited as tools to facilitate the controlled dispensing, inventorying, and re-ordering of supplies. Yet, controlled stocking and dispensing of business supplies can prevent the occurrence of inventory shortages, overstocking (which can result in business inefficiency, increased storage costs, and waste), and pilferage.

SUMMARY OF THE INVENTION

The invention provides a method and a system for distributing articles, such as business supplies. The invention may be implemented in a system that includes at least one locked enclosure, an input device, a controller, and at least one portal site. A distributed network such as a public landline or a public wireless network interconnects the controller to the portal site and provides public network access between the controller, the portal site, homes, and remote offices.

In operation, a user accesses the system for distributing articles through an input device. The user enters an identification string that uniquely identifies the user and his or her access rights. The controller verifies the user's identification string and allows access to the enclosure when the user is authorized. The controller also obtains data through either the input device or other devices to track articles removed or added to the enclosure. Preferably, the data relates to the quantity of articles in the enclosure. After receiving the data, a connection via the distributed network or a direct modem

connection is established between the portal site and the controller. The connection, which may occur on a periodic basis, allows for data and/or message exchanges.

In one preferred aspect, the system includes an identifying device, which preferably may be an audio or visual indicator. When a user selects an article, the audio or visual indicator is activated and identifies an article location.

In another preferred aspect, a connection is established between the portal site and at least one supplier. When the quantity of articles in the enclosure reaches a user-defined threshold or par value, the portal site automatically sends a message to one or more suppliers relating to the quantity of articles in the enclosure. The message may include one or more orders directing one or more suppliers to ship the desired articles to the user and may also instruct the suppliers to stock the enclosure.

In yet another preferred aspect, open access to the controller and the portal site may be provided to any authorized user from any location. Because the controller and the portal site may each have a unique address, the user can inquire as to the availability of a desired article from a remote location using a network browser. Moreover, a portal site can direct the user to one or more enclosures that have the desired article and authorize his or her access to that enclosure or that article when the method and system employ multiple enclosures. An alternative aspect envisions that the controller may also direct the user to one or more enclosures having a desired article and authorize his or her access and/or establish a direct or distributed network link with at least one supplier.

The disclosed method and system provide access to information and dispensing of articles in ways that are similar in ease-of-use to accessing the World Wide Web. The method and system allow users to browse and search for any article across multiple enclosures from any location. The method and system can track inventory, generate administrative reports, and independently initiate orders based on aggregate inventory levels of multiple enclosures to gain the benefit of volume discounts or generate individual orders based on specific enclosures to maintain just-in-time inventory levels. Moreover, because the method and system track the removal and stocking of articles through unique identification strings, individual access, use, and theft can also be monitored.

These features as well as other advantages of the invention will become apparent upon consideration of the following detailed description and accompanying drawings of the embodiments of the invention described below.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a block diagram of a first embodiment of the invention;

FIG. 2 is a block diagram of a dynamic inventory protocol of FIG. 1;

FIG. 3 is a schematic diagram of the system of the invention;

FIG. 4 is a functional block diagram of part of a portal site of FIG. 1;

FIG. 5 is a flow chart showing the methodology used to review the content of a cabinet as implemented in a system made in accordance with the teachings of the present invention;

FIG. 6 is a flow chart showing the methodology used to search the contents of a cabinet as implemented in a system made in accordance with the teachings of the present invention;

FIG. 7 is a flow chart showing the methodology used to add authorized users to the system implemented in accordance with the teachings of the present invention;

FIG. 8 is a flow chart showing the methodology used to edit user information in a system implemented in accordance with the teachings of the present invention;

FIG. 9 is a flowchart showing the methodology used to delete user information in a system implemented in accordance with the teachings of the present invention;

FIG. 10 is a flowchart of the methodology used to enter new product information in a system implemented in accordance with the teachings of the present invention;

FIG. 11 is a flow chart of the methodology used to edit product information in a system implemented in accordance with the teachings of the present invention;

FIG. 12 is a flow chart of the methodology used to delete product information in a system implemented in accordance with the teachings of the present invention;

FIG. 13 is a flow chart of the methodology used to prepare and view user reports in a system implemented in accordance with the teachings of the present invention;

FIG. 14 is a flow chart of the methodology used to create and review a consumption report in a system made in accordance with the teachings of the present invention;

FIG. 15 is a flow chart of the methodology used to create and review a discrepancy report in a system made in accordance with the teachings of the present invention;

FIG. 15A is a flow chart of the methodology used in automatically generating reports in a system in accordance with the teachings of the present invention;

FIG. 16 is a flow chart of the methodology used to poll cabinets in a system made in accordance with the teachings of the present invention;

FIG. 17 is a flow chart of the methodology used to set the minimum and maximum inventory levels for components in a system made in accordance with the teachings of the present invention;

FIG. 18A is a flow chart of a part of the process used to generate an order in a system made in accordance with the teachings of the present invention;

FIG. 18B is a flow chart of another part of the process used to generate an order in a system made in accordance with the teachings of the present invention; and

FIG. 18C is a flow chart of yet another part of the process used to generate an order in a system made in accordance with the teachings of the present invention.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

In the drawings the same reference numbers through several views designate alike and similar elements.

1. Top-Level Structure and Architecture

A system 100 embodying the invention is shown in FIG. 1. The system includes a customer site 105 having 3 cabinets 110, each with a number of pockets or compartments 115 that enclose and secure articles, such as business supplies or any other items that are preferably dispensed in a controlled manner. The compartments 115 may be slidably interconnected with the cabinet 110 in a drawer-like manner, if desired. Although it is preferred that the compartments 115 have clear acrylic doors to display articles, other types of doors may also be used. The compartments 115 are dimensioned to a variety of heights and widths to enclose and secure a variety of articles.

Electronically actuated locks (not shown) facilitate access to the articles enclosed within the cabinet 110. When in a locked state, the locks prevent the doors from being opened and prevent access to the articles. When actuated, the locks release the doors so that the articles are freely accessible. Preferably, the locks are actuated simultaneously to allow unrestricted access to the whole cabinet 110. The system 100, however, may also actuate locks independently and limit access to certain articles based on user access rights.

Input mechanisms, such as pressure sensitive switches (not shown), disposed near each drawer and compartment 115 of the cabinet 110 collect inventory information as articles are removed from or stocked within the cabinet 110. Preferably, the switches are "take" and "return" switches that are actuated each time an article is removed from or stocked within the cabinet 110. The cabinet 110 may also include an input device 120 such as a touch screen or a keyboard to track articles removed or added to the cabinet 110. The input device 120 may supplement or replace the switches.

Each cabinet 110 may also include devices that identify the location of a desired article. The devices preferably comprise visual (such as light emitting devices) or audio indicators that are actuated by the user. Such devices may be unitary with one or more of the switches, interconnected with the doors, or may be integrated with or enclosed by the compartments 115 of the cabinet 110.

With further reference to FIG. 1, a controller 125 (three are shown) is used to manage access to the cabinet 110, collect inventory and administrative data, and interface with other nodes that are accessible through its input device 120 or modem (not shown). The modem, which converts data from one form to another, interconnects the controller 125 to other nodes. The interconnections shown in FIG. 1 encompass both direct and indirect connections via a communication link. For example, with reference to FIG. 1, the modem may connect the controller 125 directly to a communications server 130 through landlines or wireless links 135 or may connect the controller 125 to a server 140 through peripheral networks and devices (not shown) that are linked to a distributed network 145 like the Internet. The term "distributed network," as used herein is intended to broadly encompass any network including public landline or a public wireless networks, in which processing, storage, and other functions are handled by separate nodes rather than a single controller or computer. As is known, one of the advantages of a distributed system is that functions are decentralized. Therefore, for example, high network traffic does not disrupt the function of the cabinet 110 or data collection that is carried out by the controller 125.

The controller 125 also includes a processor 150 and may include peripheral devices such as a display and/or a badge reader. The processor 150 controls access to the cabinet 110 and its articles and responds to user commands received through the modem or the input device 120. Preferably, the processor comprises a microprocessor-based system such as a PENTIUM™ based INTEL™ computer, for example, having static and dynamic memory that runs a known operating system such as WINDOWS™, LINUX™, or SOLARIS™, for example. The input device 120 is preferably a keyboard or a touch screen that allows users to make selections and enter information through a graphical display interface. The display may be a cathode-ray tube or a flat panel.

Although the system 100 is shown as having two servers 130 and 140, the functionality of the servers may be combined or distributed in a variety of ways. As shown in FIG.

1, a portal site 152 may be constructed to perform the functionality of the servers 130 and 140. Although not shown, the portal site 152 might include more than two servers.

Within the portal site 152 is at least one database 155 that stores information from the communications server 130 and the web server 140. The communications server 130 preferably can support concurrent communication through a direct modem connection or through the distributed network 145 with one or more of the controllers 125 and/or one or more supplier interfaces 165 (two are shown). The communications server 130 provides users with a variety of services, including tracking cabinet 110 activity, analyzing cabinet 110 inventory levels, updating the databases 155, transmitting reports to one or more nodes, modifying or updating operating and/or application software within the controllers 125 (adding new users, new products, or modifying access rights, for example), and automatically transmitting purchase orders through fax, electronic mail, or electronic data exchange links 170, or through the distributed network 145, for example. Although the purchase orders are preferably based on target inventory goals and user-defined thresholds or par values, purchase orders may also be transmitted to supplier interfaces 165 on a periodic basis regardless of monitored inventory levels. As user preferences change, it is also envisioned that the portal site 152 will provide additional services.

The one or more databases 155 are used to archive account information in relational tables. The information preferably includes user identification strings, user access rights, inventory records, controller and supplier addresses (Uniform Resource Locators, Domain Name Systems, or Internet Protocols, for example), telephone numbers, controller configuration data, application and operating software, and/or article catalogs. Workers of ordinary skill in the art will appreciate that additional administrative and inventory data can also be stored in the databases 155.

The web server 140 hosts an interactive web site 157 where users can interact with the servers 130 and 140 and the controllers 125 authorized by their user access rights. The web server 140 allows authorized users to browse cabinet inventory, search for articles, review authorized user lists, review inventory and supplier data, review article catalogs, modify article orders and par values, generate inventory reports, generate administrative reports, and generate other standard and customized reports. Because the web and communications servers 130 and 140 share some common databases, changes in these shared databases are accessible to authorized web users 160 (two are shown) and to the controller(s) 125. For example, if an authorized web user 160 connects to the web server 140 through a web browser, the authorized web user 160 may modify a par value that is then transmitted to one or more controllers 125. An authorized web user 160 from any location, thus, can configure and modify many parameters such as target inventory levels of one or more cabinets 110 using a web browser. The system 100 does not require application specific software or hardware.

Although user connections to the web server 140 are shown as direct links via the distributed network 145, connection may be made through commercial networks that provide telephone, satellite, radio, or microwave links, for example, to the distributed network 145.

The supplier interface 165 (two are shown) facilitates communication with vendors or suppliers for re-ordering of products. Preferably, the supplier interface 165 is a fax, an electronic controller, or a computer such as a server (which

may support a separate portal site). The supplier interface 165 may allow authorized users to view information relating to the articles it distributes, conduct article searches, issue purchase orders, track purchase orders, track order history, and receive account information and invoices, for example.

Automatic stocking and re-ordering are facilitated by implementing the protocol shown in FIG. 2. By way of example, the web server 140 may implement an inventory analysis engine 200 that receives user preference data 202, consumption data 204, and cabinet configuration data 206. In many instances, the user preference data 202 and cabinet configuration data 206 will be relatively static while consumption data 204 is likely to be dynamic, but any of the three could change. As will be discussed in greater detail below, the engine 200 generates an optimal inventory level 208, based on the consumption data 204, preference data 202, and cabinet configuration data 206. The optimal inventory level can be repeatedly calculated or adjusted to respond to changes in the user preference data, the consumption data, or cabinet configuration. Of course, if the inventory falls below a certain level, the communications server 130 issues or transmits an order to a supply vendor through the supplier interface 165 so that the products or articles in the cabinets 110 are timely replenished.

The overall process, expanded to include a number of customers 105, is shown in FIG. 3. A number of vendors 220 receive orders from the portal site 152 and supply customers with the necessary replenishment of the supplies required. Further details of the method and system are provided below.

2. Functional Description

FIG. 4 illustrates the functional hierarchy of the web site 157. A user may access the site using a browser installed on the controller 125 of the cabinet 110 or any other computer device connected to the distributed network 145. To access the web site 157 a user must first logon at 230 with a viable user ID and password. Once in the site, a user may select from several options: a browse cabinets option 235, a search option 240, a special order option 245, and an administration option 250.

As may be seen by reference to FIGS. 4 and 5, if the browse cabinets option 235 is selected, the site 157 permits the user to select at 260 one desired cabinet from those coupled to the portal site 152 and review at 262 the content and inventory of the cabinet. As best seen by reference to FIG. 6, if the search option 240 is selected, the user may enter a query in the form of a partial item name or description at 264 and then view items that match the query at 266, including current cabinet location and inventory. The user may then view detailed item descriptions of items in the cabinet or view cabinet inventory at 268.

The special order option 245 permits a user to connect at 270 with a supply vendor's e-commerce site. The administration option 250 permits modification of the users 275, products 277, areas 280, and billing codes (or departments) 282 maintained by the system and the generation of reports 284. The functionality supported by the site 157 to add new users is illustrated in detail in FIG. 7. A selection 285 to enter a new user is made, and new user information is entered at 286. Once all the desired information is entered, it is saved and a "user created" transaction 287 is automatically generated and queued for transfer by the communications server 130 to each cabinet 110. The user is then queried at 288 whether additional new users are to be added, and if so, steps 290, 286, and 287 are repeated.

User information may be searched by selecting a search engine option 285. An edit option 295 (FIGS. 4 and 8) may

be used to edit user information. User information is displayed and edited at 297 and saved at 299. Similar to the addition of a new user, a "user edit" transaction 301 is created and queued for transfer by the communications server 130 to each cabinet 110. The user is then queried at 303 whether additional edits are to be made. If so, the process is repeated.

User information may be deleted, by selecting a delete option 305 (FIGS. 4 and 9). A selection is made to delete a user and that selection is confirmed at 310. A "user delete" transaction 312 is created and queued for transfer by the communications server to each cabinet 110. The user is queried at 315 whether additional users are to be deleted. If so, the process is repeated.

The web site 157 provides functionality for searching, adding, editing, and deleting product information, area information, and billing code information that is similar to that provided with respect to manipulating user information. The functionality for manipulating product information is illustrated in the flow charts in FIGS. 10-12, but because of the similarity to other processes will not be discussed in detail herein. The functionality, for manipulating area 280 and billing code 282 information should be readily apparent to those of ordinary skill in the art from the drawings and description provided herein. Area information relates to a geographical, functional, or other grouping of cabinets. As its name implies, billing code information relates to the billing system used in a particular application of the invention.

To support the distribution of information collected and recorded by the system 100, numerous reports 284 may be generated through the web site 157. A report menu 284 (FIG. 4) supports report generation functionality. As best seen in FIG. 13, a user report may be generated by selecting a user report option 330, entering a department name or identification at 332, and selecting a desired user from the department at 334. The report is then output for viewing at 336.

As shown in FIG. 14, a consumption report may be generated by selecting a consumption report option 340, entering a department or user identification at 342, and selecting a date range and sort option at 344. The report is then output for viewing at 346. As shown in FIGS. 4 and 15, discrepancy, inventory, and consumption-snapshot reports may also be generated through options 350, 355, and 360 respectively. The details of generating each report are similar to those already discussed and, therefore, will not be discussed in detail.

An additional feature of the report generation described above provided by the invention relates to automating the creation and delivery of reports. An automated reporter 370 (FIGS. 1 and 15A) may be provided in the communications server 130 and accessed by the user through a browser. The automated reporter 370 queries a user for certain report related data or report attributes 372. The attributes include title, page layout, SQL (Structured Query Language) query, column attributes such as data or amounts to be totaled, and data grouped, e-mail address, start date and time for generating a report, the frequency of the report, and the period during which the report should be generated. The user provided data is saved as a "report request record" in a report query table 373. A polling agent 374 polls the table 373 on an ongoing basis. If a record is found that specifies an elapsed report date and time, the automated reporter 370 executes the SQL query, streams the results of the query into a spreadsheet file, and e-mails the file to the designated e-mail address.

As can be seen from the above, the web server 140 and web site 157 enable decentralized users to configure and

maintain data in a cabinet 110. This eliminates the requirement, common in prior systems, that the user be physically proximate to a desired cabinet or the main computer and memory that processes and stores information for the subject dispensing system.

As noted above, the communications server 130 works in conjunction with the web server 140, providing a variety of tracking, ordering, and communication services. One job of the communications server 130 is to gather information from each cabinet 110. The communications server 130 also maintains up-to-date information for each cabinet 110. In order to accomplish this, a reorder agent 375 of the communications server 130 periodically polls each cabinet 110. The frequency of the polling will depend on the configured polling time or polling frequency of each cabinet 110. For example, a cabinet 110 can be configured to be contacted daily, for example, every day at 3 pm. Alternately, the cabinet can be configured to be contacted more often, for example, every 60 minutes. The data polling process is outlined below in Table 1, and shown in FIG. 16.

TABLE 1

Communications Server 130 Polling Process

1. Server checks the communications queue to determine the next available cabinet to contact.
2. Server contacts cabinet via Internet (TCP/IP) or dial-up modem.
3. Server sends transaction information to the cabinet for all activities that occurred on the server since the last contact.
4. Server receives transaction information from the cabinet for all activities that occurred at the cabinet since the last contact.
5. If communications are successful and error-free, the cabinet is removed from the communications queue. Otherwise, the cabinet is "demoted" to the bottom of the queue to allow for re-transmission after other cabinets have transmitted.
6. The cabinet updates internal databases with new transaction information. Data includes new and modified users, products, billing codes, and cabinet system configuration.
7. Server updates the database 155 with new transaction information. Data includes item withdrawals, returns, inventory restocks, and manual cabinet reconfiguration.
8. Server evaluates cabinet polling times and adds cabinets to the queue as necessary based on the current time of day.
9. Process is repeated by returning to step 1.

Another feature of the present invention is dynamic par-leveling. This aspect of the present invention is illustrated in FIG. 17. In order to maximize efficiency in the system 100, a minimum inventory level MIN and a maximum inventory level MAX for each compartment 115 in one each cabinet 110 is set in a par-leveler 400 of the portal site 152. In this way, supplies are timely reordered to avoid running out of articles. Overstocking is also prevented.

The par-leveler 400 receives input data at 402. The data includes a delivery interval t , a lead time L , and a safety coefficient S . The maximum consumption for articles in each compartment 115 of a cabinet during the last four time intervals is determined at 404. That is, the consumption during the time periods t days ago, $2t$ to t days ago, $3t$ to $2t$ days ago, and $4t$ to $3t$ days ago is monitored and the largest or maximum consumption M of the time periods is determined. This process is conducted daily to maintain an up-to-date maximum M . Once M is calculated for the particular day at hand, the maximum order amount MAX is determined at 406. MAX is equal to M times a safety multiplier or coefficient S . In this way, the system determines an order amount, based on consumption, that should never be exceeded.

The minimum order amount, MIN, is calculated from the MAX value at 408. MIN is equal to MAX times the lead

time I divided by the delivery interval. The MIN for any compartment is the re-order point because letting the article level fall below the MIN amount will result in an out-of-stock situation. Once MAX and MIN have been established for one compartment, the process is continued until all MAX and MIN values for all the compartments have been determined, as shown at 410. As an alternative to the algorithm implemented by the par-leveler 400, the MAX and MIN may be set by a user to a user determined level.

Once the MIN and MAX values have been determined (whether by the user or through the par leveler 400) for each compartment 115 in each cabinet 110, a set of business rules may be applied to automatically generate appropriate orders and deliver those orders to vendors. The process is shown in FIGS. 18A-18C. The process starts in FIG. 18A, at 450, where for each vendor, a list of companies served by that vendor is retrieved. Then at 452, for each company served by that vendor, a list of areas for the company is retrieved. An area may be a geographical grouping of one or more cabinets or it may be a grouping of cabinets based on functional or other characteristics. At 454, a list of cabinets for each area in a company is retrieved. Then, the business rules shown in Table 2 are applied at 456.

TABLE 2

Cabinet Level Rules (can be grouped with boolean AND, OR)

1. At least x high priority items in cabinet are below MIN
2. At least x high priority items in cabinet are out of stock
3. At least x normal priority items in cabinet are below MIN
4. At least x normal priority items in cabinet are out of stock
5. At least x low priority items in cabinets are below MIN
6. At least x low priority items in cabinet are out of stock
7. Dollar value of items ordered (if cabinet was to be restocked) exceeds x
8. Current day of the week is x (Sunday, Monday, etc.)
9. Current day of the month is x (1-31)

As shown at 458, the rules are reviewed to determine if any of them evaluate to true. If so, the particular cabinet is flagged at 460 as being eligible for re-ordering. The process is repeated as shown at 462, until all the cabinets in the area have been reviewed. Depending on the particular application at hand, the cabinet level rules can be grouped together by boolean operators to create compound rules. This is also true of the other rules discussed below. Once all the cabinets have been processed, a determination at 464 is made as to whether any cabinet in the area has been flagged for re-order. If so, then the area business rules of Table 3 are applied, as shown at 466.

TABLE 3

Area Level Rules (can be grouped with boolean AND, OR)

1. At least x high priority items in area are below MIN
2. At least x high priority items in area are out of stock
3. At least x normal priority items in area are below MIN
4. At least x normal priority items in area are out of stock
5. At least x low priority items in area are below MIN
6. At least x low priority items in area are out of stock
7. Dollar value of items ordered (if area was to be restocked) exceeds x
8. Current day of the week is x (Sunday, Monday, etc.)
9. Current day of the month is x (1-31)

If any of the area business rules evaluate as true (as shown at 468), then the area is flagged for re-order at 470. As shown at 472, the process is repeated until all areas of the company have been analyzed.

Once all the areas in the company have been reviewed, a determination at 500 (FIG. 18B) is made as to whether any

area in one company has been flagged for re-order. If an area has been flagged, the company business rules of Table 4 are applied for the company being processed at 502.

TABLE 4

Company Level Rules (can be grouped with boolean AND, OR)

1. At least x high priority items in company are below MIN
2. At least x high priority items in company are out of stock
3. At least x normal priority items in company are below MIN
4. At least x normal priority items in company are out of stock
5. At least x low priority items in company are below MIN
6. At least x low priority items in company are out of stock
7. Dollar value of items ordered (if company was to be restocked) exceeds x
8. Current day of the week is x (Sunday, Monday, etc.)
9. Current day of the month is x (1-31)

If any of the company business rules evaluate as true at 504, then the company is flagged for reorder at 506. The process continues until all companies for the vendor have been processed as shown at 508. At 510, a determination is made as to whether any company vendor has been flagged for reorder. If so, the vendor business rules of Table 5 are applied at 512.

TABLE 5

Vendor Level Rules (can be grouped with boolean AND, OR)

1. At least x high priority items in vendor below MIN
2. At least x high priority items in vendor are out of stock
3. At least x normal priority items in vendor are below MIN
4. At least x normal priority items in vendor are out of stock
5. At least x low priority items in vendor are below MIN
6. At least x low priority items in vendor are out of stock
7. Dollar value of items ordered (if vendor was to be restocked) exceeds x
8. Current day of the week is x (Sunday, Monday, etc.)
9. Current day of the month is x (1-31)

If any of the vendor business rules evaluate as true at 514, then the vendor is flagged for re-order at 516. The process is repeated, as shown at 518, until all vendors have been processed. Once all the vendors are processed, orders are generated. As shown at 520, for each vendor flagged for re-order, a list of companies flagged for reorder is retrieved. Then, at 522, the list of areas flagged for reorder for each company is retrieved. At 524, a list of cabinets flagged for re-order is retrieved for each area flagged for reorder.

Each compartment for each cabinet is examined at 550 (FIG. 18C). A determination is made at 552 as to whether an order for a compartment is pending. If so, the current date is checked at 554 against the lead time needed to deliver an order. If the date is past the lead-time needed, a late notice is sent to the company expecting the order, as shown at 556. Whether or not a late notice is required, the examination of compartments continues as shown at 558 until all compartments in all cabinets have been reviewed. If there is no order pending for a compartment, the system (web server) then checks to see whether an order sufficient to fill or top-off the compartment should be issued. At 560, the system checks to see whether the top-off function is enabled. If it is, then a current inventory, CUR, is compared to the MAX value and a convenience order value CO is checked at 562. If the current value CUR is at the MAX value or the CO value is not greater than zero, then the next compartment is examined. If the CUR value is less than the MAX value and the CO value is greater than zero, an order for the CO value is generated at 564. If the top off function is not enabled, the CUR value is checked against the MIN value at 566. If the CUR value is less than or equal to the MIN value and the CO

value is greater than zero, an order for the CO amount is generated at 564. If not, the next compartment is checked. If an order is generated, the compartment is flagged as having an order pending and time-stamped at 568. Once all the compartments are examined, orders are generated and transmitted to vendors at 570.

In the process described above, the convenience order concept was introduced. The system of the present invention optimizes ordering of supplies by ensuring that re-orders are made in quantities that not only prevent overstock or out-of-stock situations, but also optimize delivery of items in standard quantities and package sizes that correspond to the quantities and sizes that manufacturers normally produce. This may be more clearly seen by reference to Table 6.

TABLE 6

<u>Re-order Methodology</u>		
Term	Definition	Example
Unit of Issue (UI)	Description of packaging for each unit dispensed from cabinet	"Disk", "1 Folder", "3-pack", "Box", etc.
Unit of Purchase(UP)	Description of packaging for each unit purchased from supplier/manufacturer	"Disk", "Dozen", "Box", "3-pack", etc.
Quantity Issued Per Unit of Purchase (QIPUP)	Number of units dispensed from cabinet for each UP.	If file folders are dispensed individually, but purchased by the box (100/box), then the QIPUP = 100
Convenience Multiple (CM)	UP multiple preferred by the supplier	If supplier sell pens individually (UP = "Each") but pens come packaged in boxes of 12, then the CM = 12, since the vendor prefers not to break packages.
CUR	The current quantity of an item, (based on UI)	If there are 12 pens in the cabinet, CUR = 12
MAX	Maximum quantity (based on UI)	If the cabine pocket holds 60 pens, and pens are dispensed individually, then MAX = 60
MIN	The minimum quantity (based on UI) of a given item that may be maintained in the cabinet without generating a restock order for the item (i.e., the reorder point)	If MIN = 12, then an order will be generated when CUR < 12
Optimal Order (OO)	The maximum reorder quantity possible (based on UP) without exceeding MAX.	Using the pen example, if MAX = 60, MIN = 12, and CUR = 10, AND QIPUP = 1.
OO = INT {MAX-CUR}	then OO = 50. Note that OO QIPUP	disregards the convenience multiple.
Convenience Order (CO)	Same as OO, but includes CM. This results in more "supplier friendly" orders, since packages need not be broken down by the supplier prior to delivery. CO = INT {OO}*CM CM	If the CM = 12 in the above example (i.e., pens sold individually, but packaged in boxes of 12), then CO = 48. Using CO for a restock order ensures that the supplier will not have to break packages.

In the example shown in Table 6, the convenience order value CO is defined based on the vending activity that occurs from a compartment 115 in a cabinet 110. However, it also considers the quantity of articles or items present in standard packages and results in orders that generally do not require vendors to provide partial purchase amounts.

As can be seen from the above, the present invention provides a method and system for controlling the dispensing of items from enclosures. The method and system provide enhanced information about the inventory and users who access the system. Further, the method and system provide

automatic re-orders or replenishment of dispensed items when inventory reaches a certain predetermined level.

The foregoing detailed description describes only a few of the many forms that the present invention can take, and should therefore be taken as illustrative rather than limiting. It is only the following claims, including all equivalents, that are intended to define the scope of the invention.

What is claimed is:

1. A method of doing business, wherein a third-party company facilitates the supply of articles from vendor companies to consumer companies, the third-party company performing the steps comprising:

supplying cabinets to multiple consumer companies, the multiple consumer companies storing articles within the cabinets;

establishing a third-party server located at the third-party company;
receiving inventory information on the third-party server regarding the articles contained within each of the cabinets;
analyzing the inventory information at the third-party server; and
placing orders through the third-party server with at least one of the vendor companies for replacement articles based on analyzing the inventory information, the replacement articles to be supplied directly to the cabinets at the consumer companies by the vendor.

2. The method of claim 1, wherein access to the articles stored within the cabinets is governed by a controller computer.

3. The method of claim 2, wherein the inventory information is compiled by the controller computer.

4. The method of claims 3, wherein the inventory information is received by the third-party server from the controller computer via one of a network or modem.

5. The method of claim 4, wherein the network includes the Internet.

6. The method of claim 4, wherein access to the third-party server can be gained via a network.

7. The method of claim 4, wherein the inventory information received on the third-party server can be accessed by any computer connected to the Internet.

8. A method of doing business, wherein a third-party company facilitates the supply of articles from vendor companies to consumer companies, the third-party company performing the steps comprising:

receiving inventory information from cabinets located in at least one of the consumer companies regarding articles contained within the cabinets,

compiling the inventory information for all cabinets in a third-party server,

using the third-party server to analyze the inventory information to assess inventory levels in each of the cabinets, and to place orders with at least one of the vendor companies the vendor companies supply replacement articles directly to the cabinets located in the consumer companies based on analyzing the inventory information.

9. The method of claim 8, wherein each cabinet is secured and has a controller computer associated with it, the controller computer governing access to the cabinet.

10. The method of claim 9, wherein the inventory information is communicated from the controller computer to the third-party server.

11. The method of claim 10, wherein the inventory information is communicated via the Internet.

12. The method of claim 9, wherein the third-party server places the orders with the vendor companies based on preset ordering rules programmed into the third-party server.

13. The method of claim 12, wherein the orders are placed over a network.

14. A method of doing business, wherein a third-party company facilitates the supply of articles from a vendor company to a consumer company, the third-party company supporting a third-party server and performing the steps comprising:

supplying a cabinet to a consumer company, the consumer company being remote from the third-party server and storing articles within the cabinet the cabinet including a controller which compiles up-to-date inventory information regarding the articles contained within the cabinet, the third-party server periodically polling the controller to retrieve inventory information from the controller,

analyzing the inventory information at the third-party server, and

placing an order through the third-party server with a vendor company to supply replacement articles to the cabinet located in the consumer company based on analyzing the inventory information.

15. The method of claim 14, wherein the inventory information communicated from the cabinets to the third-party server includes information regarding the number and type of articles within the cabinet.

16. The method of claim 14, wherein the inventory information is communicated from the controller to the third-party server via a public network.

17. The method of claim 16, wherein the public network includes the Internet.

18. The method of claim 14, wherein the orders are placed via a public network and the vendors can access the inventory information via the third-party server.

19. The method of claim 18, wherein the vendor accesses the third-party server via the Internet.

20. A method of doing business, wherein a third-party company facilitates the supply of articles from a vendor company to a consumer company, the third-party company supporting a third-party server and performing the steps comprising:

supplying a cabinet to a consumer company, the consumer company storing articles within the cabinet,

receiving inventory information on the third-party server via a public network regarding the articles contained within the cabinet,

analyzing the inventory information at the third-party server, and

placing orders through the third-party server with a vendor company via a public network for replacement articles based on analyzing the inventory information, the replacement articles to be supplied directly to the cabinet at the consumer company by the vendor.

21. The method of claim 20, wherein the public network includes the Internet.

22. The method of claim 21, wherein the inventory information is stored on the third-party server at the third-party company and the inventory information can be accessed by logging onto the third-party server through the Internet.

23. The method of claim 22, wherein a link is established via the Internet between a remote computer and the third-party server, the remote computer sending to the third-party server via the link a specific inquiry regarding the availability of a particular article in the cabinet.

24. The method of claim 22, wherein a link is established via the Internet between a remote computer and the third-party server, the third-party server governing access to the inventory information by a user of the remote computer and directing the user to the location of a particular article identified by the user.

25. The method of claim 20, wherein order information recording the orders placed with the vendor company is tracked on the third-party server at the third-party company and is accessed by the vendor company via the Internet.

26. The method of claim 20, wherein multiple cabinets are supplied to multiple consumer companies, the third-party server at the third-party company receives and analyzes inventory information regarding the articles contained within each of the cabinets, and the third-party server places orders with multiple vendor companies based on the analysis of the inventory information received from each of the cabinets at the multiple consumer companies.

27. The method of claim 20, wherein the cabinet includes at least one lockable compartment.

28. A method of doing business, wherein a third-party company facilitates the supply of articles from a vendor company to a consumer company, the third-party company performing the steps comprising:

establishing a third-party server at the third-party company,

storing on the third-party server packaging information regarding the number of a particular article packed by the vendor company within a package of the particular article,

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supplying a cabinet to a consumer company, the consumer company storing the particular article within the cabinet,

receiving inventory information at the third-party server via a public network regarding the number of the particular article contained within the cabinet,

analyzing the inventory information at the third-party server, and

placing orders through the third-party server with a vendor company via a public network for packages of the particular article based on analyzing the inventory information and the packaging information, the packages of the particular article to be supplied directly to the cabinet at the consumer company by the vendor.

29. The method of claim 28, wherein the analysis of the inventory information at the third-party server includes

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tracking the consumption of the particular article over a period of time.

30. The method of claim 29, further comprising determining the maximum amount of the article to be ordered based on the consumption of the particular article over a period of time.

31. The method of claim 30, wherein the consumption of the article over a period of time is measured according to a delivery interval and the maximum amount of the article ordered is determined using a safety multiplier.

32. The method of claim 31, further comprising determining the minimum amount of the article to be ordered based on the maximum amount of the article to be ordered, a lead time, and the delivery interval.

* * * * *

EXHIBIT D

U.S. PATENT NO. 5,525,967 TO AZIZI, ET AL.



US005525967A

United States Patent [19][11] Patent Number: **5,525,967**

Azizi et al.

[45] Date of Patent: **Jun. 11, 1996****[54] SYSTEM AND METHOD FOR TRACKING
AND LOCATING AN OBJECT**

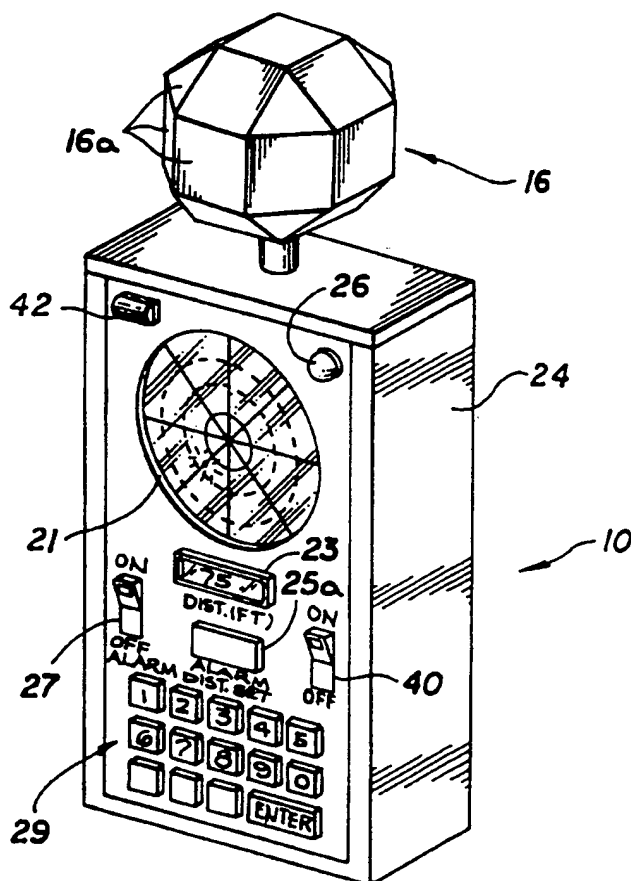
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[21] Appl. No.: **143,630**[22] Filed: **Nov. 1, 1993**[51] Int. Cl.⁶ **G08B 23/00**[52] U.S. Cl. **340/573; 340/539; 343/898;
455/277.1**[58] Field of Search **340/571-573,
340/505, 539; 455/88-90, 100, 277.1; 343/702,
718, 894, 898-99; 348/143, 152, 155, 158****[56] References Cited****U.S. PATENT DOCUMENTS**

4,868,544	9/1989	Havens	340/573 X
5,274,359	12/1993	Adams	340/573 X
5,298,883	3/1994	Pitney et al.	340/573

*Primary Examiner—Thomas Mullen**Attorney, Agent, or Firm—Rapkin, Gitlin & Moser***[57] ABSTRACT**

A system and method to monitor the specific location of a person, pet or item of personal property by employing elements that enable the user to pinpoint both the distance and the direction of the person or object being monitored relative to the position of the monitoring or transmission unit (the "source"), comprising a tracking transceiver unit, which tracks and monitors the person or object, and the target transceiver unit, which is worn or affixed to the person or object being monitored. The tracking transceiver unit broadcasts a signal to a target transceiver unit, which, upon receiving the signal, will then broadcast a response signal back to the tracking transceiver unit. The tracking transceiver unit's antenna, which comprises a plurality of flat sensor plate-like elements formed together in a generally spherical configuration, picks up the signal and then conveys the information it receives to a special response signal processor unit, which analyzes the data to determine the direction of the person or object being monitored. Information filtered and analyzed through the response signal processor unit is then conveyed to a central processor unit, which uses the data to calculate the distance of the person or object being monitored from the source.

6 Claims, 2 Drawing Sheets

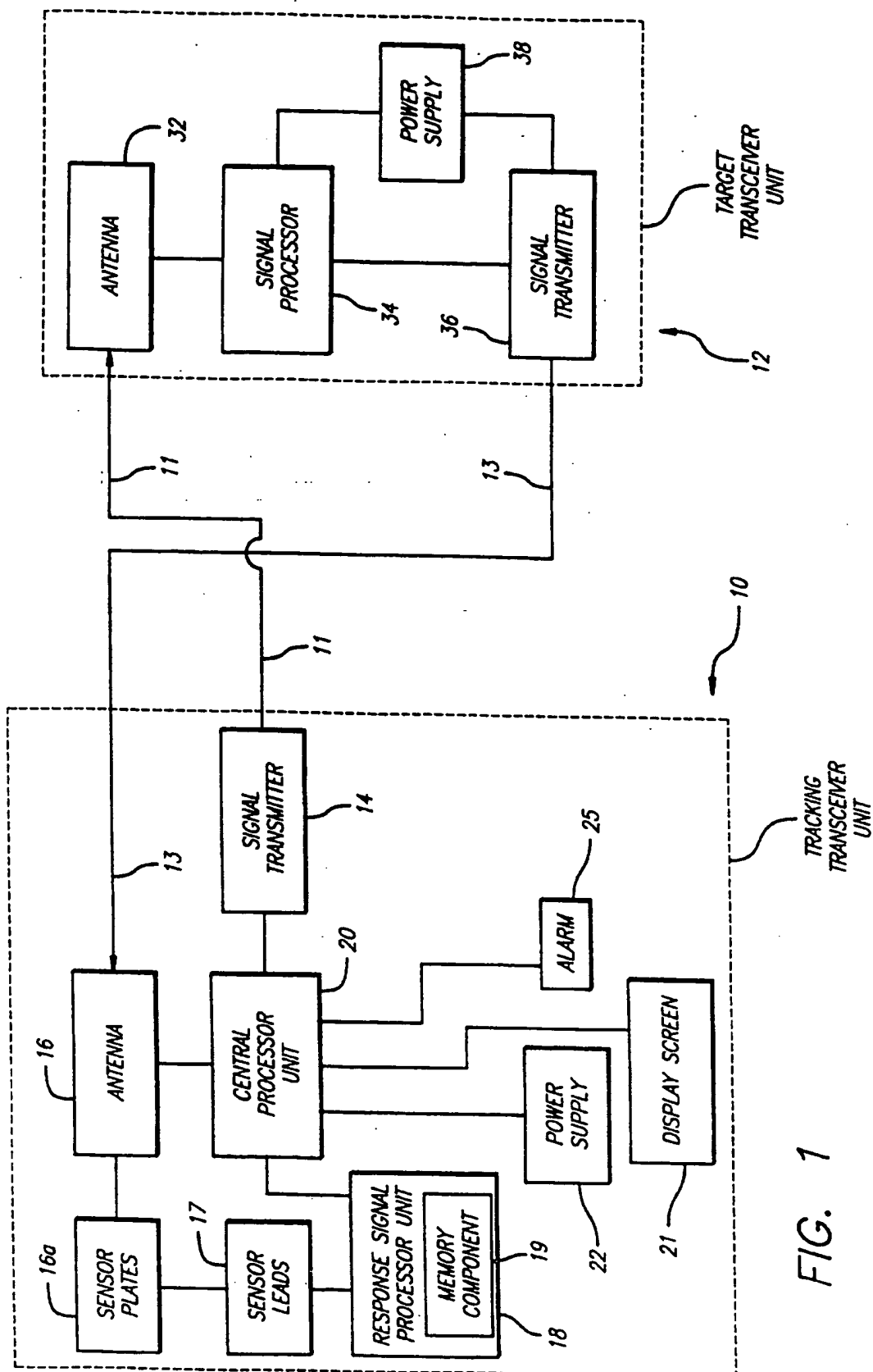
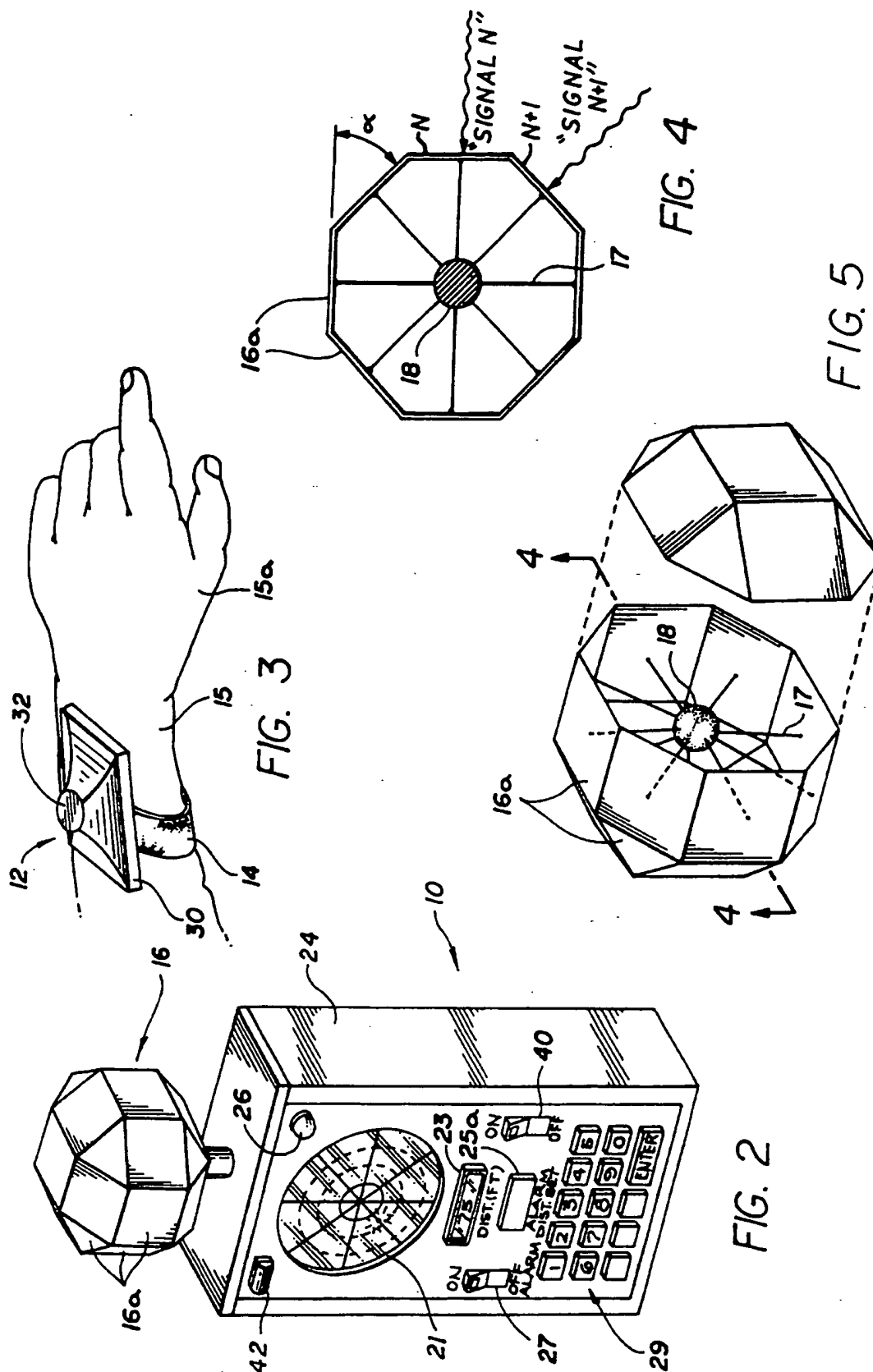


FIG. 1



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SYSTEM AND METHOD FOR TRACKING AND LOCATING AN OBJECT

FIELD OF THE INVENTION

This invention is directed generally to a system and method for tracking and locating objects, and more particularly to a system and method for electronically determining the distance and direction of an object from a specified tracking source.

BACKGROUND OF THE INVENTION

The use of systems and methods to monitor the movements and locations of a variety of objects, including individuals, pets or even items of personal property, is well known. Every year, thousands of infants and young children are lost or abducted, particularly in venues such as shopping malls and amusement parks. As any law enforcement official will confirm, the first few minutes after the child is determined to be missing are the most critical in locating the child. Pets and even items of personal property are also lost or stolen on a regular basis. Here again, the initial moments after the discovery of the loss or theft of the pet or object are the most critical in any successful effort to locate them. In the past, telemetry and radar have been used to effectively track and locate objects, both on the ground, in the water and in outer space. This type of tracking utilizes the emission of a signal from a source and the reflection of the same signal received at the source from the target being tracked. Other means of tracking objects are also known. For example, the transmitter of U.S. Pat. No. 5,119,072 includes an antenna that radiates a frequency modulated rf carrier signal to a receiver. The receiver contains circuitry for monitoring field strength of the carrier signal and for indicating range from the receiver to the transmitter as a function of such field strength. Another example is U.S. Pat. No. 5,021,794, which discloses a locator system comprising a radio transmitter concealed on the person to be located which activates and transmits a coded UHF radio homing signal upon the receipt of an initiating signal containing the person's specific code. Tracking vehicles with automatic UHF radio direction finding and distance measuring equipment are used for locating the source of the homing signal. Other examples are U.S. Pat. No. 4,990,892, which discloses a personnel locator system using infrared transmitters and receivers to monitor classes of individuals; U.S. Pat. No. 4,868,544, which discloses a shopping cart retrieval system comprising a VHF beacon radio transmitter that continuously emits a signal and a VHF receiver with an omnidirectional and directional antenna; and, U.S. Pat. No. 4,899,135, which discloses a child monitoring device that includes two or more transceivers operating in the radio or ultra sonic frequency ranges.

Monitoring systems and methods of the types generally referred to hereinabove may include a transmitter or monitoring unit, and a portable receiver removably attached to the person or object being monitored to receive a signal broadcast by the transmitter. The most common of these systems or methods employs technology that is capable only of determining the precise distance the person or object is from the transmitter or monitoring unit, and possibly may include means to alert the transmitter, by sounding an alarm, when the person or object exceeds a predetermined distance from the monitoring unit. The large majority of these systems include no capability for determining the direction of the person or object being monitored, and in these few instances

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where this capability exists, it does so at a tremendously high price due, in large part, to the involvement of complex technology and equally high manufacturing costs. In contrast to the prior art systems and methods, the present invention employs technology that combines the capability of determining accurately both the distance and the direction of an individual or object being monitored relative to the transmission or monitoring point, and achieves this at a relatively low cost of manufacturing.

SUMMARY OF THE INVENTION

The present invention provides a solution to the foregoing problems not addressed in the prior art. The present invention provides a system and method to monitor the specific location of a person, pet or item of personal property (the "person or object") by employing elements that enable the user to pinpoint both the distance and the direction of the person or object being monitored relative to the position of the monitoring or transmission unit (the "source"). The system includes, at minimum, two components, namely a tracking transceiver unit, which is the unit responsible for tracking and monitoring the person or object, and the target transceiver unit, which is worn or affixed in some fashion to the person or object being monitored. Using pulsating low frequency sound waves or radio waves, the tracking transceiver unit broadcasts a signal to a target transceiver unit, which is set to the exact frequency of the signal it expects to receive. Upon receiving the signal, the target transceiver unit will broadcast a response signal back to the tracking transceiver unit. There, the tracking transceiver unit's antenna, which comprises a plurality of flat sensor plate-like elements formed together in a generally spherical configuration, picks up the signal and then conveys the information it receives to a special response signal processor unit, which analyzes the data to determine the direction of the person or object being monitored. The memory in the response signal processor unit is programmed with information specific to each of the antenna's sensor plates, including the signal frequencies associated with each plate given a variety of expected target positions. Thus, the response signal's processor unit receives information about the signals striking the various sensor plates, identifies the strongest signal, which is most near or coincidental with the angle of incidence of one particular sensor plate only, and then compares the data to the information in the memory to identify that plate and, thus, determine the direction of the person or object being monitored. Information filtered and analyzed through the response signal processor unit is then conveyed to a central processor unit, which uses the data to calculate the distance of the person or object being monitored from the source. The precise location, including both the distance and the direction, of the target is then displayed on a screen incorporated into the housing of the tracking transceiver unit.

Accordingly, it is an object of the present invention to provide a novel tracking and locating system and method for locating a person or an object being monitored.

It is a further object of the present invention to provide a novel tracking and locating system and method that has the unique capabilities to determine both the precise distance and the direction of the person or object being monitored.

It is yet a further object of the present invention to provide a novel tracking and locating system and method which overcomes the disadvantages associated with prior art systems and methods employed to monitor and track a person or objects.

It is yet still a further object of the present invention to provide a tracking and locating system and method that employs portable transceivers to emit and respond to tracking signals.

It is yet still a further object of the present invention to provide a tracking and locating system and method that is simple and easy to use and relatively inexpensive to manufacture.

Other objects and advantages of the present invention will become apparent in the following specifications when considered in light of the attached drawings wherein the preferred embodiment of the invention is illustrated.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a functional block diagram of the system and method for tracking and locating an object in accordance with the present invention.

FIG. 2 illustrates in perspective the tracking transceiver unit in accordance with the present invention.

FIG. 3 illustrates in perspective the target transceiver unit strapped to a child's wrist in accordance with the present invention.

FIG. 4 is a cross-section of the tracking transceiver unit antenna taken along lines 4—4 of FIG. 5 in accordance with the present invention.

FIG. 5 is an enlarged, sectional view of the tracking transceiver unit antenna with a portion broken way in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the block diagram of FIG. 1, there is illustrated, in block form, the various elements of the tracking and locating system and method of the present invention, which is designed to locate and identify the distance and the direction of the person or object being monitored relative to a particular source. The system includes a portable tracking transceiver unit 10 or "source," as it will also be known, and a target transceiver unit 12, which is worn or attached in some appropriate manner to the person or object being monitored or tracked. An example of a means of securing the target transceiver unit 12 to the person or object being monitored is a strap 14 adapted to be removably affixed to the person or object by encircling the person or object or some portion thereof, such as the wrist 15 of a person's hand 15a. In the preferred embodiment of the invention, the system includes a single portable target transceiver unit 12, though the system is capable of including several target transceiver units 12 with electronic circuitry that would be set to the same frequencies as one or more of the companion tracking transceiver units 10, as the user desires.

Each tracking transceiver unit 10 includes a transmitter unit 14, a response signal receiving antenna 16, a response signal processor unit 18, a central processor unit 20, a data display screen 21, a power supply unit 22, an on-off switch 40 and an on-off indicator light 42 all enclosed within or adjoining a housing 24. Also integrated with each tracking transceiver unit 10 are an alarm unit 25, which is electrically connected to an alarm light 26, and an alarm on-off switch 27. Response signal receiving antenna 16, usually the size of a golf ball or smaller, comprises a plurality of adjoining generally flat sensor plates 16a formed together in a generally spherical configuration. Each of the sensor plates 16a

has an outwardly facing spatial orientation that is different from the outwardly facing spatial orientation of each of the other said plates 16a.

Each target transceiver unit 12 includes a housing 30 enclosing a tracking signal antenna 32, a tracking signal processor unit 34, a response signal transmitter unit 36 and a power supply unit 38.

The power supply units 22 and 38 usually consist of conventional batteries of the chargeable or non-chargeable type. The means used in each tracking transceiver unit 10 and target transceiver unit 12 for transmitting and receiving signals comprise printed circuit boards incorporating commercially available integrated circuits in the form of micro chips (not shown).

The configuration of the tracking transceiver unit 10 is normally rectangular, though it could be designed more square or oval in shape, if desired. The size of the tracking transceiver unit 10 is typically the same or similar to that of an average size portable calculator or as large as a typical walkie-talkie or relatively small portable cellular telephone. The configuration of the target transceiver unit 12, in its preferred embodiment, is as it appears in FIG. 3. As with the shape of the tracking transceiver unit 10, the configuration of the target transceiver unit 12 may vary. By design and out of necessity, since the unit usually will be carried by small children and possibly pets, the size of the target transceiver unit 12 will be considerably smaller than that of the tracking transceiver unit 10.

The tracking transceiver unit 10 is capable of generating a train of pulsating signals 11 comprising a series of low frequency sound waves or radio waves in all directions. The command for the transmitter unit 14 inside the tracking transceiver unit 10 to transmit these periodic signals 11 is given by the central processor unit 20 in predetermined time intervals, e.g. at intervals of one (1) second or more. The signals 11 transmitted by the tracking transceiver unit 10 are frequency unique to a specific target transceiver unit, which has the capability of recognizing the frequency of that particular signal and distinguishing it from the signals generated from other unrelated sources. Thus, signals generated from garage door openers, alarm remotes, cellular telephones and the like will not interfere with the effective operation of the system or method of the present invention.

The target transceiver unit 12 recognizes the signals 11 generated by the tracking transceiver unit 10 and then transmits different signals of its own, called the response signals 13. The response signals 13, which are actually comprised of a series of continuously emitted parallel sound or radio waves, are received by the tracking transceiver unit 10 enabling that unit to then identify the distance and the direction of the target object from the position of the tracking transceiver unit 10. This is achieved by analyzing the data received when the response signals 13 impact upon the various sensor plates 16a. The sensor plates 16a are designed to detect the response signals 13 that may be coming at them from any direction. Each sensor plate 16a is attached to a sensor lead 17, which itself is electrically joined to the response signal processor unit 18. The sensor plates 16a are specifically designed to sense the response signal(s) being generated by the target transceiver unit 12. Sensor plates 16a are able to recognize the magnitude of the response signals 13 based on the angle of incidence of a particular plate 16a. For example, an individual response signal 13 impacting at a 90 degree angle relative to the plane of one particular sensor plate 16a, i.e. impacting at a vertical or horizontal direction normal to the surface of the plate;

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corresponds to a preset response signal frequency already programmed into its memory component 19. The number of sensor plates 16a are proportional with the directional sensitivity of the system. The greater the number of sensor plates 16a, the better able the system will be to achieve its objective of accurately pinpointing the direction and distance of the target to the source. If, for example, "N" as shown in FIG. 4, corresponds to one or more sensor plates 16a, then N+1, N+2, etc. would correspond to an increase in that number. The angle alpha, also as shown in FIG. 4, decreases in size as "N" increases. The greater "N" is, and the greater the corresponding decrease in the size of angle alpha, the easier it will be to determine the direction of the target object more accurately.

When a response signals 13 are sent by the target transceiver unit 12, the sensor plates 16a facing the general direction of the source of the response signals 13 will relay the signal frequencies to the response signal processor unit 18. The response signal processor unit 18 includes information in its memory component 19 about each of the sensor plates 16a, including the signal frequencies associated with each plate given a variety of predetermined target positions. Thus, for example, a target sending a response signal that impacts a plate "N" at an angle alpha of 60 degrees corresponds to a frequency of 15 Hz. A signal impacting that same or some other plate nearby might result in a frequency of, for example, 25 Hz. Since there is only one highest magnitude of frequency impacting the sensor plates from any one source, the comparison of that information with the information in the memory component 19 of the response signal processor unit 18 will indicate the direction of the person or object that the system is tracking. In other words, the response signal processor unit 18 will read the information conveyed to it by the sensor plates 16a through the sensor lead 17, analyze that information and then determine which plate's data is closest to the preset response signal frequency already programmed into its memory component 19. Information about the specific plate identified ("incident plate"), which indicates the direction of the person or object being tracked, along with the information about the time the individual response signal 13 impacted upon the sensor plate(s) 16a ("time incidence") is then sent to the central processor unit 20, which interfaces with the other components integrated within the tracking transceiver unit 10. The central processor unit 20 also keeps track of the time the tracking signal 11 was sent to find the target transceiver unit 12. With this information, together with the information about the time of incidence, the central processor unit 20 is then able to calculate the distance between the target object and the tracking transceiver unit 10. This distance is determined by taking the elapsed time, i.e. the total time it takes for a single tracking signal 11 to travel to the target transceiver unit 12 and a single response signal 13 to travel back to the response signal receiving antenna 16, less the preset amounts of time the target transceiver unit 10 and the response signal processor unit 18 will each require to process the signal information.

The mathematical formula for determining this distance is the following:

$$D = \frac{(T - T_1 - T_2 - T_3) V}{2}$$

Where

T=total elapsed time from the initiation of the command to the reception of the response signal by the central processor unit

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T_1 =the time elapsed from the moment the signal transmission command is initiated until the signal transmission commences from the source

T_2 =signal elapsed time of travel between the source and the target transceiver

T_3 =target transceiver signal processing time

T_4 =signal elapsed time of travel between the target transceiver and the source

T_5 =source signal processing time

V=signal velocity per unit time

Having identified the incident plate, and, thus, the direction of the target object, this information is then translated into a preprogrammed two dimensional coordination. This, together with the information about the target object's distance from the source, is then sent to the liquid crystal data display screen 21 where it is illustrated employing dots and lines on an X-Y coordinate 360 degree location grid. The screen 21 is preferably round, though it may also be oval, square or rectangular in shape. The tracking transceiver unit 10 may also provide a second display screen 23 for indicating, by the use of appropriate number references, the actual distance, in feet for example, of the target object from the source. As with the data displayed on the screen 21, the central processor unit 20 will also interface with the screen 23 and send the calculated distance information to the screen 23 to be displayed in the appropriate form.

The alarm unit 25 is interfaced with the central processor unit 20 which, with the information known about the distance and direction of the target object, can convey a signal to the alarm unit 25 if the target object exceeds a predetermined distance from the tracking transceiver unit 10. In this event, the central processor unit 20 will command the alarm unit 25 to sound an audible and/or visual alarm signal such as, for example, the flashing alarm light 26. The predetermined alarm distance perimeter, which is set by depressing the alarm distance set button 25a, may be illustrated on the display screen 21 as well. An alarm on-off switch 27 is also provided to activate and de-activate the alarm mode. A key pad 29 is provided to set alarm distance parameters.

The system and method of the present invention can utilize, at any one time, multiple tracking and target transceiver units so long as the units are properly matched and calibrated to corresponding frequencies, a task normally performed by the manufacturer before the components are sold. A single tracking unit may also be coupled with one or more target units provided the frequencies are properly matched and calibrated.

While the invention will be described in connection with a certain preferred embodiment, it is to be understood that it is not intended to limit the invention to that particular embodiment. Rather, it is intended to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

We claim:

1. A system for monitoring and determining the location of an individual, pet, or item of personal property, comprising:

a tracking transceiver unit adapted for broadcasting a first signal;

a target transceiver unit adapted for receiving said first signal being broadcast by said tracking transceiver unit and broadcasting a second signal to said tracking transceiver unit, said target transceiver unit having means for securing said target transceiver unit to the individual, pet or item of personal property to be monitored;

an antenna means connected to said tracking transceiver unit for omnidirectional and directional reception of the second signal being broadcast by said target transceiver unit, said antenna means comprising a plurality of adjoining generally flat sensor plates formed together in a generally spherical configuration, each of said plates having an outwardly facing spatial orientation that is different from the outwardly facing spatial orientation of each of the other of said plates;

a response signal processor means having a memory component therein, said response signal processor means connected to the antenna means for receiving said second signal and comparing said second signal with a predetermined identifier programmed within said memory component, said predetermined identifier including a plurality of individual signal frequencies associated with each of said sensor plates such that for a given sensor plate, each of said individual signal frequencies is associated with a different predetermined direction relative to the orientation of said sensor plate wherein a second signal impacting said sensor plate at an angle of incidence normal to said plate produces the highest individual signal frequency corresponding to said plate thereby indicating the direction of the target transceiver unit from the tracking transceiver unit;

a central processor means for correlating information processed through said response signal processor means, said information comprising said second signal, the identity of several said sensor plates upon which said second signal impacts and several said angles of incidence formed by said second signal and several said sensor plates at the points of impact, and analyzing said information to provide an indication of the distance and direction of said target transceiver unit from the position of said tracking transceiver unit wherein the determination of the distance is calculated by dividing by two the total elapsed time it takes said first signal to travel from said tracking transceiver unit to said target transceiver unit and the corresponding said second signal to travel from said target transceiver unit to said tracking transceiver unit less the time required to process said first and second signals through said target transceiver unit and said tracking transceiver unit; and

a viewing means operably connected to said central processor means for displaying data indicating the distance and direction of said target transceiver unit from the position of said tracking transceiver unit.

2. The system as in claim 1 wherein said means for securing said target transceiver unit comprises a strap for carrying said target transceiver unit adapted to be removably affixed to the individual, pet or item of personal property by encircling a part of the individual, pet or item of personal property.

3. The system as in claim 1 wherein said tracking transceiver unit is portable.

4. The system as in claim 1 wherein said target transceiver unit is portable.

5. The system as in claim 1 wherein said tracking transceiver unit includes circuitry means for activating an alarm signal when said target transceiver unit exceeds a predetermined distance from the position of said tracking transceiver unit.

6. A method of electronically monitoring the location of an individual, pet or item of personal property, comprising the steps of:

broadcasting a first signal from a tracking transceiver unit to a portable target transceiver unit positioned in an area containing said individual, pet or item of personal property to be monitored, said portable target transceiver unit being secured to said individual, pet or item of personal property to be monitored;

producing a second signal in said target transceiver unit in response to said first signal broadcast by said tracking transceiver unit and broadcasting said second signal to said tracking transceiver unit;

detecting said second signal by said tracking transceiver unit through an antenna comprising a plurality of adjoining generally flat sensor plates formed together in a generally spherical configuration;

receiving said second signal from said antenna into a response signal processor means to identify a single said sensor plate from among said plurality of adjoining flat sensor plates according to the strength of said second signal and relaying the identity of said sensor plate so identified from among said plurality of adjoining flat sensor plates to a central processor unit for analysis to determine the distance and direction of the individual, pet or item of personal property being monitored from the position of said tracking transceiver unit; and

displaying information about said distance and direction of the individual, pet or item of personal property being monitored on a viewing screen.

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